BOTANICAL MUSEUM LEAFLETS
HARVARD UNIVERSITY

CAMBRIDGE, MASSACHUSETTS WINTER 1984 VOL. 30 NO. 1

THE BOTANICAL MUSEUM OF HARVARD UNIVERSITY IN ITS 125th YEAR

1858–1983

The year 1983 marks the 125th anniversary of the founding of the Botanical Museum of Harvard University. It seems, therefore, appropriate to review the present state of the Museum from the point of view of its academic, research and public activities.

The Botanical Museum is one of five institutions at Harvard devoted to the plant sciences, its sister institutions being the Gray Herbarium, the Farlow Herbarium, the Arnold Arboretum and the Harvard Forest. Each is devoted to different aspects of botany. The Museum's fields of activity—economic botany (including several types of ethnobotany), paleobotany and orchidology—are diverse and, in scope, world-wide. They are likewise strongly interdisciplinary in character, basically biological but impinging upon other fields of science and the arts: anthropology and archaeology, chemistry and pharmacology, history, geology, horticulture, to mention only several.

Partly as a result of the wide orientation of the work of the Museum, research by members of its staff and students has attracted attention in fields other than the plant sciences, sometimes in fields distant from botany. It is particularly noteworthy

Botanical Museum Leaflets (ISSN 0006–8098). Published quarterly by the Botanical Museum. Harvard University, Cambridge, Massachusetts 02138. Subscription: $40.00 a year, net, postpaid. Orders should be directed to Secretary of Publications at the above address. Second-Class Postage Paid at Boston, Massachusetts.

Published November 15, 1984

that all of the areas of teaching and research in the Museum are marked by this peculiarity of integrating material from and impinging upon several other disciplines.

The Botanical Museum dates from 1858, when Asa Gray wrote to Sir William Hooker, Director of the Royal Botanical Gardens at Kew: "I must tell you in humble imitation of Kew I am going to establish a Museum of vegetable products, etc., in our University." Hooker sent over duplicate economic botany materials from Kew, and these became the nucleus of a collection that grew in a somewhat desultory manner until 1878, when its care was added to the many other duties of Professor George Lincoln Goodale. Goodale saw this as the "germ of something large and fine"* and felt "...that such an assemblage, freed of casual elements and constructively developed along economic lines, might function both as illustrative material for the teacher and as a reference collection to which even the specialists might turn for much-needed information—a place where rare drugs could be identified or unusual fibres compared."*

The University named Goodale first director of the Botanical Museum in 1888, and the building of the Museum was completed under his direction in 1890. The period of active life of the Museum dates actually from the naming of its first director. Not the least unique aspect of this active life was the creation from 1887 through 1936 of the widely known Ware Collection of Blaschka Glass Models of Plants which constitutes today, in addition to its basic function as an adjunct in teaching botany, the major public attraction in the University.

Over its century and a quarter history, the Botanical Museum has grown into one of the world recognized centres of research in the plant sciences. Yet its reputation has developed differently from that enjoyed by many other outstanding botanical institutions, in part because the Museum's research, exploration and teaching, both university and public, are interdisciplinary in nature, transcending the usual strict boundaries of the plant sciences. During the past half century, these aspects of the Museum's activities have enjoyed an especially steady develop-

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*Samuel Eliot Morison (Ed.) "The development of Harvard University, 1869-1929," Harvard University Press, Cambridge, Mass. (1930).

ment and expansion with the impetus given by the second and third directors of the Museum, Professor Oakes Ames and Professor Paul C. Mangelsdorf, respectively.

Research

Research is a major keynote of the Museum's philosophy. It is carried out not only in the laboratory, herbarium and library, but also in the field. Every aspect of the Museum's research involves field work or extensive exploration in a great variety of regions, including Mexico, the Andes and Amazonian parts of South America, Greenland, Canada, South Africa, Australia, Afghanistan, to name only a few of the areas where the staff and students have worked. It has also involved research in agricultural experimental fields. Lastly, certain aspects of its research have concerned historical and archaeological aspect of ethnobotany.

Teaching

The Museum's teaching activities have materially enriched the course offerings in Harvard's Department of Biology on both the undergraduate and graduate levels. Recent courses by its staff have introduced students to the complexities of evolution of crop plants, paleobotany and the evolution of plant life through geological time. The country's oldest course in economic botany, currently known as "Plants and Human Affairs," has strongly influenced many of its students who have continued in academia, in science, in industry and in medicine. Numerous courses in various specialized phases of economic botany and the effect of plants on history have during the past twenty years been offered to the public in Harvard's Commission on Extension. The course "Plants and Human Affairs" has also been taught on several occasions in Harvard's Summer School program and advanced courses in medical botany have, until recently, been part of the offerings of the Department of Biology.

Graduate student doctoral research supervised by the Museum staff has encompassed a wide spectrum of topics in paleobotany (Precambrian evolution of life, Pleistocene vegetation patterns

in Eastern North America and Central America, the anatomy of Tertiary woods and fruits), economic botany (ethnoecology of Amazonian and Mexican tribes, generic monographic treatments of economic plants of tropical America, ethnobotany of Andean Indians, biological studies of maize and its relatives) and in orchidology.

Exhibits

One purpose of a museum is public service, providing a link between specialists and the public. In this activity, the Botanical Museum has excelled throughout most of its century and a quarter of existence. Although devoted primarily to university teaching, its exhibits have always been open to the public. Although now drastically limited, due to recent severe space restrictions, they still continue to draw more than 100,000 visitors a year from all parts of the world. Millions know the Museum as the home of the "Glass Flowers," officially called the Ware Collection of Blaschka Glass Models of Plants. Another exhibit presents pioneering research carried out by the Museum staff and students on Pre-Cambrian plants variously dated at from 3,000,000,000 to 3,400,000,000 years of age.

Until recently, two rooms housed extensive exhibits of economic plant products (including a large collection of ambers and Chinese laquer-ware), and an entrance hall presented displays of ongoing Museum research on the origin and biology of maize, on archaeoethnobotany and on narcotic and hallucinogenic plants of the New World. These widely acclaimed exhibits were unfortunately dismantled due to a reshuffling of space and its loss to the Botanical Museum.

Economic botany: ethnobotany

The Museum's oldest field of interest, going back to the very founding of the Museum in 1858, is economic botany which is at present based on several unique collections, especially on the Laboratory of Economic Botany with its collection of economic plant products and herbarium of economic plants and on the

Economic Botany Library of Oakes Ames, comprising over 30,000 titles.

The term, economic botany, has always been broadly interpreted in the Botanical Museum to signify interdisciplinary studies on plants useful or harmful to man: consequently included are not only those plants of value to our modern agricultural and industrial civilization but also the often complex relation of primitive or pre-literate cultures to their ambient floras.

The introductory course in eonomic botany—"Plants and Human Affairs"—has been taught since 1876 and is now offered annually to graduate and undergraduate students of Harvard University and Radcliffe College. The most widely used textbook in this field—Hill's *Economic Botany*—was written at the Museum by a member of the staff and is based on the current Museum's collections and library. Throughout its history, various workshops, symposia and seminars in topics in economic botany have been held in the Museum and, under the sponsorship of the Museum, in South America.

Studies in economic botany in the American tropics have been extremely constant and productive. Of special and novel interest has been the ambitious search through the 4,500,000 specimens in the Harvard University herbaria for collector's notes on the native uses of foods and medicinal plants—research which has resulted in an extremely successful book.

Investigations into the economic botany of numerous commercially important groups of plants have characterized much of the Museum's recent effort: Hevea and other rubber-producing plants; Brugmansia, Erythroxylon, Theobroma, Cannabis, to name only several.

One major aspect of economic botany has been the extensive archaeological, morphological, taxonomic and genetic research on the origin of cultivated plants, especially maize, in the studies of which a unique group of scientists spent over a quarter of a century investigating the origin, evolution, structure, history and other aspects of this major cereal, including research on remains of primitive maize from Mexico and South America. Furthermore, advanced courses have been offered on the origin of other cultivated plants.

Ethnobotany, or the study of the relationship of plants and primitive societies, has played a significant role in the Museum's economic botany programme. During the past fifty years, intensive ethnobotanical studies have been carried forth, especially in tropical America. These have encompassed field and laboratory investigations in ethnopharmacology, ethnoecology, ethnomycology and archaeoethnobotany, concentrating particularly in the study of medicinal, narcotic and toxic plants. The investigations have been carried out primarily in Mexico, Colombia, Ecuador, Brazil and Peru, although the research in ethnomycology has been much wider.

Since the 1930's, one of the specialized branches of ethnobotany that has been seriously pursued is ethnomycology—the relationship of fungi and human affairs. Research in this field has been carried out in the United States, Mexico, Japan, India, and Europe.

The Museum's facilities in archaeoethnobotany—the study of archaeological plant remains and their significance to both plant evolution and man's social and cultural evolution—have attracted scholars from far and wide. The research in archaeoethnobotany has been especially focused on Peru and Mexico, particularly on specific crop plants such as maize, including the origins of agriculture in these countries. This effort has led to the creation of an extensive study collection of archaeological plant remains, one of the few in the United States, and to the publication of significant books and articles in this neglected field. Recent research on vegetal remains in Egyptian, Peruvian and Aleutian mummies has been a novel undertaking of the Ethnobotanical Laboratory.

The most recent development has been the initiation of active effort in conservation in cooperation with the World Wildlife Fund. An Ethnobotany Specialist Group has been set up to bring together ethnobotanists from around the world in the realization that folklore concerning plants and their uses is fast disappearing with the encroachment of civilization. This programme is a logical extension of the Museum's longstanding ethnobotanical activities.

Paleobotany

Another long established part of the Museum is the Laboratory of Paleobotany. The collection of fossil plants, constituting one of the most valuable of the world because of its wealth of type specimens, has been the basis of research in plant evolution for nearly a century. Linking botany and geology, Harvard's paleobotanical research has in recent years studied the oldest forms of life yet discovered, some specimens dated at more than three billion years of age.

The staff and students of the Laboratory of Paleobotany have been active in field work in sundry parts of the world: North America, Greenland, South Africa, Australia.

The Bailey-Wetmore Laboratory of Plant Anatomy and Morphology

Although the Wood Collection, basis of the Bailey-Wetmore Laboratory of Plant Morphology and Anatomy, is not exclusively a part of the Botanical Museum, it is housed in the museum. This facility represents the union of wood samples from the Biological Laboratories, the Gray Herbarium, the Arnold Arboretum, the Harvard Forest and the Botanical Museum—the second largest scientific wood collection in the United States. It is under the direction of a committee of representatives of the several institutions.

Orchidology

The Orchid Herbarium and Library of Oakes Ames, comprising a collection of more than 100,000 herbarium specimens and many thousands of spirit collections of orchids from every continent and an associated library of some 5,000 titles, represents the world's largest herbarium devoted to a single plant family. Originally dedicated mainly to purely taxonomic and floristic research, its importance to wider fields of research has recently been established in such disciplines as cytology, genetics, phytochemistry, phytogeography and horticulture. Members of the staff of the Orchid Herbarium have, during the past half century

or more, carried out exploration in many parts of both hemispheres, especially in the tropics.

Although the staff of the Orchid Herbarium is concerned primarily with taxonomic and floristic investigation, it offers valuable consultative services to orchidological horticulture.

The Economic Botany Library of Oakes Ames

This unique library of some 30,000 titles is topically indexed to uses of plants as well as to names of plants. Basic to the teaching of various aspects of economic botany, it is organized especially for student use. It is, however, a research tool of extreme importance, consulted by students and scholars from mmany fields at Harvard and by researchers from other universities in the greater Boston area. It is completely interdisciplinary in scope, organization and aims.

The Tina and Gordon Wasson Ethnomycological Collection

Given to the Botanical Museum by Dr. R. Gordon Wasson and dedicated in February, 1983, this collection represents the only facility in the world set up specifically for research in the history and influence of fungi in human affairs. It is basically an interdisciplinary library of approximately 8000 titles, including sundry items in foreign languages that are not often found in this country and numerous valuable rare herbals and other volumes published in medieval Europe.

Associated with the library is a collection of art and archaeological artifacts: carvings of mushrooms in jade, ivory, bone and wood from Asia; stone "mushroom gods" from Guatemala, some dated approximately 600 B.C.; a 2000-year-old Mexican shaman communing, with her hand on a large mushroom; Japanese and Chinese paintings; posters; drawings; American Indian documents; and other objects.

This collection is available to research scholars whose interests lie in studies of the role that fungi have played in civilization.

Publications

The BOTANICAL MUSEUM LEAFLETS OF HARVARD UNIVERSITY, now in its 29th volume, has been a major outlet for the scientific papers of its staff and students. Printed until recently on our own press, it has published papers of worldwide interest with many novelties and discoveries in orchid taxonomy, new genera and species of tropical America, origin of cultivated plants, economic botany, Amazonian ethnopharmacology, ethnobotany, ethnomycology, phytochemistry and paleobotany. The staff has likewise published over the years a large number of books in these fields, a number out of all proportion to its small size. Especially notable is the production of books in orchidology, for the orchid floras of a large percentage of New World countries have been the products of the Botanical Museum: North America, Trinidad and Tobago, Mexico, Guatemala, Venezuela, Ecuador, Peru, lesser Antilles and Okinawa.

Commemorative Events During 1983

During this 125th year of the Botanical Museum, several events in recognition of the anniversary have been planned and carried out. In February, the Tina and Gordon Wasson Ethnomycological Collection was dedicated. The halls and cases where the Glass Flowers are exhibited were air-conditioned for control of humidity to safeguard the models, some of which are nearly a century old, from dust and deterioration. The first extensive book on the Glass Flowers, illustrated with 85 colour photographs of the models and published in December 1982, was made available to the public at the sales desk of the Museum.

The Botanical Museum is a small institution, yet its influence has spread far and has been felt in many circles, primarily because of the interdisciplinary character of all of its teaching and research. It proudly takes its place among the institutions dedicated to the advancement of botany around the world.

THE STAFF OF THE BOTANICAL MUSEUM IN 1983

Richard Evans Schultes, Ph.D., M.H.(hon.), Jeffrey Professor of Biology; Director; Curator of Economic Botany.
Paul C. Mangelsdorf, Ph.D., Fisher Professor of Biology Emeritus; Director Emeritus.
Elso S. Barghoorn, Ph.D., Fisher Professor of Biology, Curator of Paleobotanical Collections.
Leslie A. Garay, Ph.D., Curator, Orchid Herbarium of Oakes Ames.
Andrew H. Knoll, Ph.D., Associate Professor of Biology.
Howard J. Allgaier, Printer.
William A. Davis, M.A., Keeper of Scientific Exhibits.
Mary R. Gaudet, Staff Assistant.
Katheryn M. Harrow, Staff Assistant.
Scott E. Wilder, B.A., Curatorial Assistant.
Doris E. Ward, Typist - Secretary.
Wesley Y.Y. Wong, M.A., Library Assistant.

ADJUNCT APPOINTEES

Loran C. Anderson, Ph.D., Associate in Economic Plants.
Michael J. Balick, Ph.D., Associate in Plant Domestication.
Umesh C. Banerjee, Ph.D., Associate in Palynology of Cultivated Plants.
Elizabeth A. Coughlin, M.L.A., Associate of Botanical Museum.
G.C.K. Dunsterville, B.S., Associate in Orchidology.
William A. Emboden, B.S., Associate in Ethnobotany.
Norman F. Farnsworth, Ph.D., Associate in Ethnomedicine.
Alvaro Fernández-Pérez, Quim. Farm., Associate in Medical Botany.
Thomas T. Furst, Ph.D., Associate in Ethnobotany.
Francis W. Hankins, M.E., Associate in Paleobotany.
Fritz H.P. Hamer, Associate in Orchidology.
Bo Holmstedt, Docent M.D., Associate in Medical Botany.
Dorothy A. Kamen-Kaye, A.B., Associate in Ethnobotany.
Mark J. Plotkin, M.F.S., Associate in Ethnobotanical Conservation.
Timothy C. Plowman, Ph.D., Associate in Ethnobotany.
Robert F. Raffauf, Ph.D., Associate in Medicinal Plant Chemistry.

Siri von Reis, Ph.D., Associate in Ethnopharmacology.
Frederic Rosengarten, A.B., Associate in Economic Botany.
Judith Schmidt, Ph.D., Associate in North American Ethnobotany.
Gunnar Seidenfaden, D. Phil., Associate in Orchidology.
Emly Steffan Siegerist, B.A., Associate in Orchidology.
John E. Stacy, M.A., Associate in Orchidology.
Tony Swain, Ph.D., D. Sci., Associate in Phytochemistry.
Herman R. Sweet, Ph.D., Honorary Curator of the Oakes Ames Orchid Herbarium.
Margaret A. Towle, Ph.D., Associate Curator of Ethnobotanical Collections.
R. Gordon Wasson, B. Litt., Associate in Ethnopharmacology.
Andrew T. Weil, M.D., Associate in Ethnopharmacology.
Johannes Wilbert, Ph.D., Associate in Latin American Amerindian Folk Medicine.

Richard Evans Schultes
Jeffrey Professor of Biology;
Director, Botanical Museum

THE PALEOBOTANICAL COLLECTIONS

The Paleobotanical Collections of the Botanical Museum constitute an unusually comprehensive documentation of plant evolution in geologic time. The more than 60,000 specimens in the collections make Harvard the nation's second largest repository for fossil plants in terms of size alone. If one considers completeness of stratigraphic, geographic, and taxonomic coverage, the Botanical Museum collections are without peer. Fossils in the Paleobotanical collections range from simple prokaryotic microfossils preserved in 3400 million year old cherts from South Africa to wooden artifacts discovered in Indian and colonial archeological sites in New England. The collections include materials from all continents (as well as extraterrestrial carbon isolated from meteorites) and all geologic periods. Thus, the Paleobotanical Collections provide unique oportunities for education and research.

THE AGASSIZ INFLUENCE

The name of Louis Agassiz is usually associated with the Museum of Comparative Zoology, but the eminent Swiss paleontologist was also instrumental in the establishment and early growth of Harvard's fossil plant collections. Agassiz immigrated to America in 1847, following the suppression of his home institution, the Academy of Neuchâtel, by the Geneva Revolutionary Council. Fortunately for the development of paleobotany in North America, he soon persuaded his Neuchâtel colleague Leo Lesquereux to join him in America (Darrah, 1934). Lesquereux' deafness prevented him from acquiring an academic position, but in late 1848 he moved to Columbus, Ohio, to aid William Sullivant in his studies of bryophytes—a post that still required Lesquereux to support his family by making watches and

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The delegation of the Botanical Museum in the academic procession of the Commencement, June 1983. From left to right: Professor Loran Anderson, Professor Richard Evans Schultes, Professor Andrew Knoll, Professor Tony Swain, Miss Elizabeth Coughlin, Professor Robert J. Raffauf.

(Photograph: Stephen Jennings)

jewelry. As Lesquereux' reputation as a bryologist grew, so did his distinction as a student of fossil plants. Lesquereux' research on the Mississippian and Pennsylvanian floras of Pennsylvania and several other states culminated in the publication of his monumental *Description of the Coal Flora of the Carboniferous Formation in Pennsylvania and throughout the United States* (1879–83). This work stands as the first great monograph on American fossil plants, and the specimens described therein thus have particular scientific and historical significance. Because of Lesquereux' association with Agassiz—Lesquereux spent several months each year working on collections at Harvard—many of the *Coal Flora* collections were deposited in the Boston Museum of Natural History, from which they were moved to Harvard in 1892. Darrah (1969) estimated that some 60% of Lesquereux' type and figured specimens from the *Coal Flora* are housed in the Paleobotanical Collections of the Botanical Museum; most of his later collected types reside in the United States National Museum.

Lesquereux' interest in fossil plants was not restricted to the Carboniferous System; he collected widely in the Cretaceous and Tertiary beds of the United States, and much of this material is also housed in the Botanical Museum.

Other collectors also contributed to the early growth of Harvard's paleobotanical collections. Agassiz was responsible for bringing much now classic material to Cambridge from Europe, and the combined talent of Agassiz and Lesquereux made Harvard an attractive place to deposit many of the important fossil plant collections that were being discovered in the latter half of the nineteenth century. The list of collectors who donated fossil plant specimens to the Agassiz Museum includes many of the great names in paleontology: men such as Walcott, Bronn, Dawson, and Lyell. Some 800 beautifully preserved specimens collected by Oswald Herr from the Miocene lake beds of Oeningen, Switzerland, were deposited in the Museum, and more than 2000 fossils from the Cretaceous Denver and Dakota groups were identified by Lesquereux from material collected by Arthur Lakes and Charles Sternberg.

In sum, the magnet of Agassiz' fame and the prodigious work of Leo Lesquereux together provided the foundation for the Paleobotanical Collections. These early collections include rare materials from Europe that are not available elsewhere in the United States as well as many of the Lesquereux Coal Flora specimens, an assemblage that as much as any qualifies for the title of America's "type" paleobotanical collection.

THE PHANEROZOIC COLLECTIONS

The Botanical Museum was established in 1858. Forty six years later, the Paleobotanical Collections were formally instituted as a part of the Museum. The new collections brought together material previously housed in the Museum of Comparative Zoology and the extensive collections of the Boston Museum of Natural History. Many of these collections, including those of Lesquereux, were poorly curated and catalogued. Robert Tracy Jackson, a respected zoologist specializing in the study of echinoderms, undertook the task of curating these collections, and it is because of his effort that these important fossils are available for continued study today.

The Paleobotanical Collections expanded upon their already formidable base in the closing years of the nineteenth century and the early decades of the twentieth through the acquisition of several major collections and numerous smaller ones. Important gifts of this period include a diverse suite of European fossils donated by E.C. Lee, a large collection of Miocene plants from the Latah Formation of Washington contributed by E.E. Alexander, the Schary collection of Devonian plants from Hostin, Bohemia, and the Rogers collection of material from Triassic and Jurassic localities in Virginia, North Carolina, and the Connecticut Valley.

Carboniferous plants remained central to the research activities of paleobotanists associated with the Museum. Of particular importance is the Lomax Collection, a selection of some 300 thin sections of coal balls cut by the British lapidary James Lomax and acquired by E.C. Jeffrey. These sections display the anatomy of Carboniferous plants with unrivaled clarity, and

many are of special significance in that they were cut from fossil surfaces immediately adjacent to those used by D.H. Scott to illustrate his classic text *Studies in Fossil Botany* (1900). Much new Pennsylvanian material was also added to the collections during the tenure of William Darrah as curator from 1936 to 1941. In addition to his own extensive collections, Darrah arranged exchanges for European materials identified by Jongmans and Bertrand and acquired a large collection of the famous Mazon Creek nodules collected by Frederick Thompson, a long-time friend of paleobotany and a Research Fellow in the Museum. Several thousand coal ball peels were prepared and identified during this period, many of them by a young Harvard graduate student named Elso Barghoorn, and these continue to play an important role in paleobotanical teaching in the Department of Organismic and Evolutionary Biology. More recent additions to the Museum's Carboniferous collections include materials from the Pennsylvanian of New England deposited by John Oleksyshyn, Paul Lyons and colleagues, Clifford Kaye, Edward Grew and C.E. Grant. A newly acquired assemblage donated by Henry L. Barwood documents Pennsylvanian floras from the Warrior Basin of Alabama.

Other addititions to the Paleobotanical Collections have included a varied suite of fossils particularly rich in Triassic specimens from Arizona donated by Lyman Daugherty, an extensive collection of beautifully preserved Middle Devonian plants presented to the Museum by Raymond Baschnagel, and an unrivalled collection of Cretaceous and Tertiary fossil woods donated by the late Frank Hankins, a Research Fellow in the Museum. The petrified wood collection includes several thousand geographically widespread specimens and constitutes a major source of information on angiosperm wood evolution that has yet to be fully investigated. These collections have been added to the Paleobotanical Collections during the curatorship of Elso S. Barghoorn, Fisher Professor of Natural History. During his 36 years at Harvard, Professor Barghoorn has increased the collections not only through the acquisition of gift materials but also through his own extensive field work. Of particular

importance is material of the Brandon Lignite, Vermont, collected in several expeditions during the period 1947–1977 by Barghoorn and his students Alfred Traverse, William Spackman, and Bruce Tiffney.

The coal collections at Harvard are appropriately maintained as part of the Paleobotanical Collections. The basis for this collection is a large suite of materials acquired by E.C. Jeffrey, whose innovations in coal petrology led to an increased understanding of the origin of coal (Jeffrey, 1925). Knowledge of the origin and constitution of coal and related sediments is fundamental to coal utilization in technology. The petrographically determined botanical composition of coal is closely related to its coking properties and gasification behavior. Although coal science *per se* is not now part of research activities in the Paleobotanical Laboratories, the collections at Harvard have provided part of the background for research programs in both government and industry and for graduate students who have become leaders in coal research. The Jeffrey collections have been supplemented through the years, especially by the addition of specimens collected by Barghoorn. Today, the collections include several thousand samples, thin sections, and macerations, representing most of the major coal basins of the world.

THE PRECAMBRIAN COLLECTIONS

For the past thirty years, the Paleobotanical Laboratories have been closely identified with research on the early evolution of life, and because of this, the Precambrian paleontological collections have achieved a size and importance that justifies their discussion in a separate section.

The earliest acquisition of Precambrian materials by the Botanical Museum was in 1937, when a collection of fossil calcareous algae, stromatolites, and pisolites was purchased from C.L. and M.A. Fenton. Although much of this material is Phanerozoic in age, some of the stromatolites come from the Middle Proterozoic Belt Supergroup in Montana. These and all other presumed Precambrian fossils were at the time considered

to be little more than poorly understood curiosities. A new perspective on early evolution emerged in 1952 when Stanley Tyler, an economic geologist from the University of Wisconsin, contacted Barghoorn concerning structures resembling microorganisms that he had observed in petrographic thin sections of the 2000 million year old Gunflint Iron Formation, Ontario. (Tyler and Barghoorn had already begun to collaborate on the investigation of a 2000 million year old coal from the Michigamme Formation of Michigan—surely one of the rarest items in the Coal collections.) Barghoorn confirmed the structures as microfossils, and in a subsequently published report (Tyler and Barghoorn, 1954), the two scientists quadrupled the known length of the fossil record and ushered in a new era of paleobiological research on the earth's most ancient rocks. Barghoorn and Tyler made several collecting trips to the Gunflint in the 1950's, and since that time further collections by Barghoorn and his students have increased both the size and comprehensiveness of Harvard's Gunflint collection. Upon the death of Stanley Tyler in 1963, his entire collection of Gunflint thin sections was given to the Paleobotanical Collections. The Harvard Gunflint collections include carbonaceous shales, stromatolites, anthraxolites, and other associated sedimentary rocks, as well as fossiliferous cherts, and they continue to serve as source material for paleobiological and geochemical research.

The Gunflint provides the historical nucleus of the Precambrian collections, but numerous additional research projects involving Barghoorn and his students have increased the scope of the collections tremendously during the past two decades. The collections now include material ranging in age from the Isua Supracrustal rocks, at 3800 million years old the oldest known rocks on earth, to the base of the Cambrian Period. Some 70 formations from six continents are represented. In addition to the Gunflint Formation, highlights include some of the oldest fossiliferous material known, microfossiliferous cherts from the 3400 Ma old Swaziland Supergroup, South Africa, and the original collections of the important Late Precambrian biota of the Bitter Springs Formation, Australia. Collections made by A.H. Knoll in the Late Precambrian sequences of Svalbard and East

Greenland are unrivalled for their paleoenvironmental comprehensiveness and their high degree of stratigraphic and paleoecological control. These collections also include a large number of planktonic fossil assemblages prepared from Late Precambrian rocks of the Arctic, Australia, Europe, the Soviet Union, Africa, and North America, including, curiously, some from Cambridge, Massachusetts.

Type materials include those from the Gunflint, Bitter Springs, Fig Tree, Skillogalee, Narssârssuk, Draken, Hunnberg, and Ryssö formations.

ASSOCIATED COLLECTIONS

THE POLLEN COLLECTION. Palynology is the study of pollen, spores, and other organic microfossils. Long recognized as an important tool in stratigraphic studies, palynology is now employed in a wide variety of paleobiological and paleoclimatic investigations as well. The Harvard Pollen collections constitute a reference collection documenting the pollen and spores of some 11,000 species of extant vascular plants. Although species represented come from many parts of the globe, the collection is especially rich in tropical American and Chinese material. These collections are currently used in basic research in palynology and have provided source materials for several Ph.D. theses completed at Harvard. Fossil pollen and spore collections are also included in the Pollen Collection; most notable among these are material from the Oligocene Brandon Lignite prepared by Alfred Traverse and Holocene pollen and spores from Gatun Lake, Panama, described by Alexandra Bartlett.

THE WOOD COLLECTION. The wood collection, approximately 30,000 specimens, and the wood microscope slide and other anatomical collections (ca. 30,000) constitute a large informational reservoir concerning plant structure. The wood sample collections are also of potential use in studies of the physical properties of woods and their chemical composition. Although no program of instruction or research in wood technology is now offered, the collections are available and curated for such potential utilization.

THE FRUIT AND SEED COLLECTION. Like studies of fossil pollen and wood, systematic investigations of fossil fruits and seeds necessitate a reference collection of modern materials. A large collection of mature reproductive organs of both gymnosperms and angiosperms is maintained as a separately curated resource for paleobotanical studies. Though world wide in coverage this collection is especially rich in material from tropical America and southeastern Asia. The collection is comprehensive with respect to the flora of the Isthmus of Panama and lowland Costa Rica.

CONCLUSION

The Paleobotanical Collections are a comprehensive and well curated resource for research and teaching in the comparative morphology and anatomy of vascular plants. As they have for many decades, the collections provide a focus for Harvard courses on plant evolution in geologic time. They also continue to provide research materials for faculty and students in residence at the Paleobotanical Laboratories, as well as visiting scientists—not only paleobotanists but, increasingly, also geochemists. The several hundred type specimens ranging in age from Precambrian to Quaternary retain their importance as standard paleobotanical references. We can only conclude by reiterating our opening statement: the Paleobotanical Collections of the Botanical Museum constitute a unique source of scholarly information on the evolution of photosynthetic organisms.

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THE BAILEY-WETMORE LABORATORY OF PLANT ANATOMY AND MORPHOLOGY

In 1933, Professors Irving W. Bailey and Ralph H. Wetmore of Harvard University decided to coordinate their future research efforts in comparative plant anatomy and to pool their botanical collections (mostly wood) with those of the late Professor Edward C. Jeffrey. Professor Jeffrey had been internationally recognized for his technical skill and pioneering research into the anatomy of vascular plants, which culminated in his textbook, *The Anatomy of Woody Plants* (1917). Jeffrey also had applied his extensive knowledge of paleobotany and plant anatomy to the complex problem of the botanical and geological origins of coal (Jeffrey, 1924). Later he expanded this into a more popular but nevertheless comprehensive book entitled *Coal and Civilization* (1925).

Bailey and Wetmore, among other notable twentieth century botanists, had studied plant anatomy with Jeffrey and shared his conviction that comparative anatomy was a fundamental and indispensable subdiscipline within the broad context of Plant Biology. They therefore initiated a wood collection for the Department of Biology (Wetmore, personal communication,

1983), in the hope that it would provide information on wood anatomy, which might prove valuable to botanists with diverse research and teaching interests. Bailey and Wetmore displayed extraordinary foresight in their belief that a study of the comparative anatomy of woody plants often helps to unravel complex problems in the evolutionary history and phylogeny of many groups of plants and thus might contribute towards classification of woody plants into "natural" groupings of species, genera, families and orders. Fifty years later, the study of comparative anatomy maintains this fundamental relevance to diverse facets of plant biological, evolutionary and systematic research.

The task of fund-raising for this effort fell largely to Wetmore, who received support from various sources within the University. The Department of Biology allocated space and cabinets for the collections and provided funding for several years, with partial support from the Arnold Arboretum and various granting agencies. Most of the money, however, was provided by the Milton Fund. Professor Samuel J. Record of the Yale School of Forestry also assisted the fledgling Harvard collection by purchasing duplicate microslides for the wood collection which Yale at that time possessed. Bailey, Wetmore and Record enjoyed a long collaboration during the growth of their respective collections which accelerated and stimulated the development of wood anatomy as a modern botanical discipline in the United States.

Collecting expeditions to Cuba and Panama by Wetmore and several of his students further expanded the wood collection, as did later expeditions to temperate and tropical regions by other botanists who provided both wood and voucher herbarium specimens for Harvard's growing collection. By 1940, the collection included over 22,400 microscope slides of wood thin-sections and macerations, as well as some 15,000 wood samples of more than 9,000 species, 280 genera and 267 families of gymnosperms (conifers/"softwoods") and angiosperms (flowering plants/"hardwoods"). As plant structural and evolutionary research progressed, Bailey, Wetmore, Record, and their students and colleagues continued to deposit additional specimens and microscope slides in both the Harvard and Yale wood collections.

These institutional facilities have since played a vital role in both botanical and wood technological research, and continue to serve as indispensable sources of information not only on wood and its properties, but also about plant-structural adaptation and evolution. Bailey, Wetmore, Record and their graduate students were perhaps the most prolific and influential of the early 20th century American wood scientists, both through their research and teaching efforts. Bailey and Wetmore are well known for their pioneering research into applications of wood anatomy to problems of plant evolution and classification, whereas Record's unequalled contributions were largely to the identification and commercial utilization of temperate and tropical woods.

During the past century and a half, specimens of wood had been accumulating in the Gray Herbarium, the Arnold Arboretum, the Botanical Museum and the Harvard Forest. In 1940, it was decided to unite all of this material with that collected in the Department of Biology by Bailey and Wetmore. Initially this collection was housed in the Biology Laboratories, but in 1955 it was moved into the newly completed Harvard University Herbaria at 22 Divinity Avenue. During the summer of 1973, the wood collection was moved into a completely renovated area in the basement of the Botanical Museum, adjacent to the Museum's Paleobotanical Collections which include the extensive Hankins Collection of Fossil Forests (woods). This was largely the result of the efforts of Research Assistant Elisabeth Wheeler and graduate student Bruce Tiffney. On January 7, 1974, the President and Fellows of Harvard College approved the establishment of the Bailey-Wetmore Laboratory of Plant Anatomy and Morphology, as the facility in which the Harvard Wood Collection is housed. Professor Elso S. Barghoorn was designated as the Supervisor of the collection and an informal advisory committee was formed, including representatives of the several institutions involved in the development of the collection.

Today, Harvard's Wood Collection contains over 30,000 specimens of more than 300 woody plant families as well as some 35,000 microscope slides of wood and an additional 15,000 micro-slides of stems, leaves, flowers and pollen. These collec-

tions are of diverse geographic origin, with especially strong representation for tropical Asia, Australia and the Americas. Most woods have been processed into micro-slides and 60–70% of these collections are documented with herbarium specimens in the Harvard University Herbaria or elsewhere.

The collection serves the international scientific community, as a source of wood samples with matching microscope slides, which can be used in not only botanical and wood technological investigations but also in archeological, ethnological, ecological, fine arts and forensic research.

Archeologists and ethnologists often must identify wooden objects to understand the uses of plants in past and present cultures. Wood anatomy and growth rings of trees not only may reveal the identity of the species, but also reflect the ecological conditions experienced by the individual tree from year to year. Even disease and insect attacks on trees are recorded in their wood, as traumatic tissues which are easily detected. In many cases, the mineral content of the wood reflects the nature of the soil in which the tree grew: silica (sand) grains in the wood of trees from sandy, siliceous soils; calcium oxalate crystals in trees from limestone (i.e., calcium carbonate) soils; and aluminum compounds in wood grown in aluminum-rich (bauxite) soils. Hence, the study of wood structure can provide the archeologist, botanist and ecologist with information about the climatic and edaphic history of a particular region or site.

Since trees of the temperate zones of the world normally produce a single growth increment annually, a tree's age can be determined easily from its rings. The bristlecone pine (*Pinus aristata*) of the Rocky Mountain region may reach an age of 4,000 years: growth rings thus provide both a calendar and climatic record for historic and prehistoric times. Cross-matching of the rings (of known age) with those of archeological timbers (dendrochronology), can serve to estimate the age of these timbers and the sites from which they were unearthed. Other non-botanists who benefit from the wood collection are cabinet makers, carpenters, museum conservators and fine arts professionals, who can use wood anatomy not only to identify and authenticate wooden objects, but also to understand the chemi-

cal and physical nature of various woods, and thus take appropriate measures for their preservation.

The value of the wood collection to commerce also is appreciable. Although there are over 40,000 woody species of flowering plants (hardwoods) in the tropics, only some 600 are internationally traded and of these only 20 or more species constitute more than 90% of all commercial exploitation of wood. Since the anatomy of wood determines its physical and mechanical properties and limitations, it indirectly determines the utility and commercial value of wood species as a timber resource. Hence, the Harvard Wood Collection represents a valuable (although largely untapped) facility to the timber and wood products industries, as a repository for both samples of and information about lesser known species of wood with previously unexploited commercial potential.

Current curatorial projects in the wood collection include the cataloguing and addition of the Charles Sprague Sargent collection, made for the 10th Census of North American Forest Trees, which was completed for the United States Forest Service in 1884. This exquisite collection includes over 1200 uniformly sized and highly polished wood blocks representing 412 species of North American forest trees. Sargent's collection is an excellent teaching aid and source of material for various research problems in botany, forestry, wood science and technology. These woods and data about their origin and physical properties have been included in a monographic forest census published by Sargent in 1884. Ironically, it appears that no researchers in botany, forestry, or wood technology have made much use of this priceless wood collection.

Another curatorial project now underway is the collection of both wood and voucher herbarium specimens from plants cultivated at the Arnold Arboretum. The Harvard Wood Collection already includes over 400 such specimens gathered prior to the 1940's by various botanists. This continuing program will provide a repository for plants which have been removed from the Arboretum's living collections; while assembling unique research material with which botanists can compare the anatomy of many unrelated plants native to diverse habitats and geographic

regions throughout the world but growing under the same ecological conditions. Such studies are needed to help distinguish between plant structural features which are determined genetically and those induced by environmental conditions.

ACKNOWLEDGEMENTS

I am deeply indebted to Professor Ralph H. Wetmore for sharing his memories of Botany at Harvard throughout the past fifty years, which both inspired this article and insured its historical accuracy. I also wish to thank P ofessors Elso S. Barghoorn and Richard Evans Schultes for their encouragement and helpful editorial comments.

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THE ORCHID HERBARIUM OF OAKES AMES

A commitment to orchid culture, or rather the "must" of possessing a living orchid collection, is well known to have been a top priority on the list of desiderata of the aristocracy of England and Europe during the 19th Century. This infectious charm of the period, which dominated especially the Victorian era, quickly extended its presence to the New World, where, among others, North Easton, Massachusetts, was a logical place for it to take up a new residence.

The success of this transatlantic migration is clearly written in the pages of horticulture: *Cypridedium Amesianum, Laelia Amesiana, Phalaenopsis,* F. L. Ames, *Laelia anceps* var. *Amesiana, Luisia Amesiana,* to mention a few. All of these orchids commemorate the Honorable Frederick Lothrop Ames of North Easton, Massachusetts: "a zealous cultivator", ..."a liberal patron of horticulture and the possessor of one of the finest collections of orchids in North America", writes Reichenbach. However, orchids were grown not only by Frederick, but also by other members of the Ames family, including his cousin, Oliver, Governor of Massachusetts, 1886–88. Oakes Ames, son of Oliver, was born into such an environment in 1874.

Oakes's interest in plants, wild flowers and orchids, starting in his childhood, has been told many times in various biographical sketches. His total commitment to the scientific study of orchids, however, took place on October 20, 1898, when he prepared his first scientific description and drawings to be published nine days later as *Catasetum arachnoides* Ames in the AMERICAN GARDENING. The result was exciting. Oakes Ames discovered that he could fly...and for his enthusiasm only the sky was the limit.

Thus, in 1899, the Ames Botanical Laboratory was established, according to unpublished notes by Professor Ames, for the study of botanical problems and for original research. The nucleus of this new institution was a carefully assembled collection of orchid specimens. As a matter of fact, the preparation of an orchid herbarium had been started by Oakes Ames in 1889, when he was only 15 years old. At that time, in addition to samples of native orchids, he painstakingly prepared pressings of single flowers of exotic orchids which he collected from the greenhouses of his father and his father's cousin, as well as from other orchid collections, such as the W. W. Lunt collection or those of Henry Graves in Orange, New Jersey. In 1899, the orchid herbarium began to grow rapidly through the active purchase of specimens as well as through material received for identification, especially from the Bureau of Science in Manila, the Philippines.

It has been said repeatedly that no one becomes a true botanist, unless he be born with such a charisma. In retrospect, we may say that the young Oakes Ames not only reflected the marks of a true botanist but was obviously destined to stand as a symbol and inspiration for all future students of orchidology. Although as a member of the faculty, he had access to the rich botanical library of Harvard University, Ames knew the immense advantage of owning a personal reference library. On April 15, 1901, he noted in his journal: "If we really wish to make a study of orchids, we ought to begin with the earliest records, the old herbals, for example." Sparing neither effort nor zeal, Oakes worked steadily to build and enlarge the foundation as well as the structure of his orchidological realm.

By 1904, the orchid collection had grown to a rather impressive size, close to 10,000 sheets. An official count was made in September of that year through the application of a consecutive numbering system within an inscription of "HERBARIUM—OAKES AMES", a system still in use today. Since the herbarium was considered by Ames primarily as a working tool, it became a depository of much and varied information on orchid species in addition to the storage of dried specimens. Included were original descriptions, photographs, drawings of floral details, life size copies of type-specimens, published plates and similar documents which would be of use for identification purposes.

In 1905, while Ames was on vacation, his assistant, Dr. Leavitt, answered in his name a letter which came from the Bureau of Science in Manila asking him to write up the orchid part of a projected flora of the Philippines. Upon his return, Ames was dumfounded by the colossal task that had been undertaken in his name, for his information of the Philippine orchids was indeed pitifully inadequate. His inner strength and clear vision found him literally within 24 hours on board the Steamship Saxonia in the company of two of his assistants, Dr. Leavitt and Mr. Eaton, heading for Europe to study and to photograph type material of Philippine orchids preserved in the herbaria of the British Museum of Natural History, the Royal Botanical Gardens, Kew and Rijksherbarium of Leiden.

Perfection and persistence are the best descriptive expressions of the work of Ames and the studies carried out under his supervision. Both highly critical and scholarly books and papers were published one after the other in rapid succession and in a tradition that was not only expected but eagerly awaited by the scientific world. Thus, in 1905, the first volume of a series of seven was printed under the title, ORCHIDACEAE. His botanical resources, rich as they were, never satisfied him. Consequently, Ames's emphasis on documentation reached into the most unexpected places. Already in 1908, he had secured a full set of photographic reproductions of all orchid specimens from the herbarium of Linnaeus, kept in the Linnean Society in London, England, of which he was one of the few foreign fellows.

Step by step, year after year, he systematically built up a collection of photographic representation of types from Kew, the Lindley Herbarium and from Paris. The morning of May 6, 1914, when the provisions of the will of Reichenbach expired, the determined Oakes Ames was sitting on the steps of the Natural History Museum of Vienna awaiting its opening to have a first-hand look at the buried treasures of the Reichenbach Herbarium.

Over the years, a number of people helped Ames to build his ever expanding Botanical Laboratory. In 1915, the freshly graduated but polio-stricken Harvard man, Charles Schweinfurth, was hired to work in the Herbarium to look after the living orchids in the Ames's greenhouses. This new appointment turned out to be one of the rare concurrences of fate when the right man was given the right job at the right time. It did not take long for Ames to recognize that Schweinfurth's memory and especially his power of observation for minute details could be put to more constructive use in the laboratory than in the greenhouses. That prudent step paid a magnificent return. For the next 50 years, Charles Schweinfurth not only helped to expand the orchid herbarium, but also maintained its tradition of high scholarship and careful research beyond Professor Ames's active time of participation. His Harvard colleagues on November 29, 1965, presented him with a citation:

"Fifty years have passed since our colleague, Charles Schweinfurth, initiated his productive career in Orchidology. Dean of the world's orchidologists, like his predecessors Lindley, Rolfe, Reichenbach, Schlechter, Kraenzlin, Smith and Ames, he has made invaluable contributions to our knowledge of the systematics of the orchids of both the Old and the New World. His great number of publications, his elucidation of the intricate structures of orchid flowers, his augmentation to our knowledge of the phytogeography of orchids, his acute powers of observation for minute details, his loyalty and his dedication to his chosen field stand as an inspiration to both present and future students of orchidology. In grateful recognition of these fifty years of service to orchidology, we of the Botanical Museum of Harvard University, present this scroll."

Although fully committed to the study of the orchids of the Philippines, Ames was very much aware of the fact that the understanding of the complexity of the orchid family cannot be based upon a single, regional study. Therefore, studies on Central American orchids had already commenced in 1908, on Bornean orchids in 1918, a complete nomenclatorial revision of the orchids of the United States and Canada was completed by 1924, and the orchid flora of Peru was started in 1922. To these were added in the 1930's the orchids of Guatemala and the orchids of Mexico as well as the monumental revision of the genus *Epidendrum* in Central America.

Such a broad scope of undertakings naturally requires the joint efforts of many people. Professor Ames was fortunate to have had a very profitable and most cordial relationship with the elite of orchidology: Rolfe, Schlechter, Kraenzlin, J. J. Smith, Ridley, Hayata and Summerhayes. Even a scanty excerpt from the correspondence with these giants would easily amount to a sumptuous volume. Yet the cumulative knowledge of all and the ideas exchanged with each one of them together formed the time-tested foundation upon which the Orchid Herbarium as an institution proudly and firmly rests.

When Schlechter was preparing his book ORCHIDOLOGIAE SINO JAPONICAE PRODROMUS in 1918, at the end of World War I, he immediately got in touch with Ames, who not only helped him with much needed literature but also commenced to describe with him jointly several new species from China based on material in the Ames Orchid Herbarium. This cooperation blos-

somed into an important but little known partnership with the ultimate goal of publishing jointly a new FOLIA ORCHIDACEA, which eventually would cover all of the genera of the orchid family. Several unpublished keys to species of various genera attest to this undertaking in the archives of the Herbarium. Naturally, Schlechter's untimely death terminated the project. One important paper, prepared for this joint undertaking, DAS SYSTEM DER ORCHIDEEN was, however, published posthumously under Schlechter's name only, as evidenced by the unabridged copy of the original manuscript in the Ames Orchid Library.

Professor Ames always devoted full attention to the smallest details in every study he undertook. In the Schlechter-Ames project, he would have handled alone all of the genera endemic to the New World as well as those from the Philippines. To this end, an artist was employed by him in Berlin to make life-size drawings and tracings of all type specimens described by Schlechter. Hundreds of these drawings are now the only available information which we have of the Schlechterian species, since Schlechter's herbarium of some 100,000 orchid specimens was destroyed during World War II.

Busy and versatile as he was, Professor Ames never neglected to pay attention to enhancing the scientific value and expanding the resources of his by then world-famous orchid collection. In the summer of 1924, Ames agreed to pay some 400 German gold marks to Kraenzlin as a subsidy to publish Kraenzlin's MONOGRAPH OF MASDEVALLIA. On November 8, 1924, Kraenzlin requested additional help in the same amount. In return for this favor rendered, the Ames Orchid Herbarium now possesses a rather large part of the Kraenzlin Herbarium, especially of the species described by him.

The means and methods of acquisitions were indeed varied, but so is the collection, which is exceedingly rich in type and isotype specimens. The Herbarium's rate of growth not only exceeded all expectations but also reached such proportions and value that serious steps had to be taken for its preservation for the benefit of the scientific world rather than the personal interest of an orchidologist-philanthropist. Professor Ames, true to

his stature as a farsighted scientist and conscientious philanthropist, made the following presentation to Harvard University in 1939:

> "It is now my intention to give my herbarium and associated library to the Botanical Museum of Harvard University under conditions similar to those governing the gift of my economic botanical collections in 1918, it being understood that during my active life I shall have control of the herbarium and its policies under the conditions that now prevail.
>
> "In order that my herbarium shall be efficiently maintained and in no way a burden on the university in the future, it is my intention at this time,. . . .to establish a fund. . . the income from which fund shall be used to pay the salary of a curator. This fund with any subsequent additions to be recorded as the Oakes Ames Fund for Orchidology.
>
> "If at some future time the University should deem it wise to erect a fireproof structure to house the now scattered herbaria, I should be willing to have my herbarium, on the understanding that it should be kept as a distinct unit, (and to this there is no administrative obstacle), transferred to that building and be designated as the Orchid Herbarium of Oakes Ames. . .".

Perhaps it should be noted here that the Orchid Herbarium was housed first in Professor Ames's residence at North Easton, Massachusetts. Then, it was moved to his home at 355 Commonwealth Avenue in Boston. Eventually, it was installed in the Botanical Museum of Harvard University, where it was at the time that the gift was made to Harvard. One more move took place in 1954 to 22 Divinity Avenue, where a new herbarium building had just been completed. Unfortunately, Professor Ames died in 1950, but the members of the Corporation of Harvard University, through Mr. Kane, sought the approval of Mrs. Oakes Ames, because they wanted to honor him with a new location for his herbarium. The following exchange of correspondence is part of the record:

> "North Easton, Mass. June 29th, 1953. Dear Mr. Kane: It is gratifying to my children, as it is to me, that the Harvard Corporation wishes to place the Orchid Herbarium of Oakes Ames in the new Botany Building in a place of honor.
>
> "Our understanding is that can be done in accordance with the stipulation of his deed of gift to Harvard and his herbarium and library be kept as a working unit.

"I have told my sons and daughters of your kind explanation and intention and I should like to state again how much your interest has meant to us in these circumstances. Very sincerely yours, (signed) Blanche Ames Ames (Mrs. Oakes Ames)."

Mr. Kane's reply:

"July 2, 1953. My dear Mrs. Ames: Thank you so much for your lovely letter of June 29. It is indeed a source of great satisfaction to me, and I know it will be to the other members of the Corporation, to know that the placing of the Orchid Herbarium of Professor Ames in the new Botany Building will meet with your approval and that of your family. It is my understanding that not only can this be done in accordance with the stipulation in the deed of the gift of Professor Ames but also that the present members of the Department strongly favor this from the professional point of view.

"As details of the arrangements are worked out, we will be very happy to keep you informed.

"With kind regards, I am most sincerely yours. (Signed) R. Keith Kane."

44 years have passed since the Orchid Herbarium of Oakes Ames became the property of Harvard University. In 1954, the first official curator, Dr. Richard Evans Schultes, was appointed and held the office until 1958, when the present curator succeeded him. Many of the projects started or inspired by Professor Ames were brought to a conclusion during these four decades. During this period also, new projects were undertaken and new floristic studies completed. Above all, the available facilities have been much enlarged.

At the time of the gift, the Orchid Herbarium and Library of Oakes Ames encompassed some 60,000 herbarium specimens, over 2,000 bottles of orchid flowers preserved in alcohol, nearly 15,000 glycerine slides of dissected flowers and a highly specialized orchid library of approximately 2,000 volumes.

With these orchidaceous materials came also a very special gift, the collection of original drawings of Blanche Ames, wife of Professor Ames. These drawings, each a work of art by itself, lavishly illustrated Professor Ames's scientific writings. The highest quality of scholarship and the highest quality of art were truly wedded.

The Orchid Herbarium today has nearly 130,000 specimens—this number includes approximately 25,000 specimens on permanent loan from the joint herbaria of the Arnold Arboretum and the Gray Herbarium—and a working library of some 5,000 titles, as well as a collection of over 25,000 glycerine slides of dissected flowers. Moreover, it possesses a unique filing system of some 150,000 cards, recording every described orchid name, whether at the specific or infraspecific level.

The collection itself contains over 10,000 type specimens or type collections of species described by Allen, Ames, Blume, Robert Brown, Correll, Garay, Kraenzlin, Lindley, Pabst, Quisumbing, Reichenbach, Ridley, Rolfe, Schlechter, Schultes, Schweinfurth, Seidenfaden, Sweet, J. J. Smith and L. O. Williams.

The greatness of an institution does not depend upon its past glory, but rather upon its current vitality. Since funds have always been a major obstacle to progress at Harvard, the Curator for the past 25 years had to manage the Herbarium literally single handed, without any technical and secretarial help. To maintain a greater visibility among both scientific and horticultural circles, as well as to enhance its international image, the prestige of affiliation with the Ames Orchid Herarium has been extended by invitation to renowned scientists and orchidophiles to become research Associates in Orchidology. Such appointments also carry the prestige of being Officers of Harvard University for the duration of the appointment. Already listed among "Adjunct Appointees" of the staff of the Botanical Museum, these outstanding scientists and orchidologists through their harmonious team work have constantly ensured a high quality research. Although each and every one pursues independent investigations, their mutual involvement in each other's research, not through persuasion, but rather through scientific curiosity and dedication, reflects a healthy and sound environment which is devoid of competition for continuous productivity.

This productivity is clearly reflected in the number of books and lengthy monographs (nearly 50 volumes) and other scientific papers numbering in the hundreds, all of which were wholly

or to a great extent based on the resources of this herbarium and library. It can be said safely, if not boastingly, that with a very few exceptions, all orchid floristic studies, especially those of the New World, were prepared either at the Ames Orchid Herbarium, or were mostly based on the holdings of this institution.

The Ames Orchid Herbarium has, indeed, become a haven for those who seek critical information about the unique Orchid Family. Being at the cross roads of scientific and horticultural endeavors, the facilities of the Ames Orchid Herbarium are continually used by a large number of visitors, especially those from foreign countries. Among the holdings of the Herbarium, the Philippine and Mexican collections are the most extensive in the world. This truth is so aptly expressed by Dr. Valmayor in the preface written in August 1983, to her two-volume "Orchidiana Philippiana", after having spent a considerable time in the herbarium for the preparation of these books:

> "The Ames Orchid Herbarium of Harvard University . . . is considered the mecca for Philippine Orchidologists, and this is because almost all the type specimens of Philippine orchids are represented in its collection. . . . Moreover, the Orchid Library of Harvard University is so extensive that almost all valuable early taxonomic books on orchids are to be found there."

May these kind words not only sum up the treasured history of this herbarium, but also keep on echoing it in every concerned heart for an unending and promising future.

Leslie A. Garay
Curator of the Herbarium

THE ECONOMIC HERBARIUM OF OAKES AMES AND THE TEACHING COLLECTION OF USEFUL PLANT PRODUCTS

One of the specialties of the Harvard Botanical Museum has long been the study of economic botany which includes ethnobotanical research. Extensive teaching and research in this inter-

disciplinary field have been carried on by the Museum staff for over a century. The course in economic botany, now entitled "Plants and Human Affairs", has been taught for 107 consecutive years by five educators; it represents the oldest course in the sciences at Harvard University and the oldest course on this subject possibly in the world.

Among the numerous facilities at the Museum which support teaching and research in economic botany, one of the most important is the Economic Herbarium of Oakes Ames. There are actuallly two separate Ames herbaria at Harvard: the Economic Herbarium located in the Botanical Museum, and the Ames Orchid Herbarium, now housed in the University Herbaria building.

The Economic Herbarium was presented to the University by Professor Oakes Ames early in 1940. Although a small herbarium of useful plants had existed previously from the collections of Professor Asa Gray and Professor George Goodale, it was Ames' efforts from the early 1900's to 1940 that assembled the beginnings of a significant and very specialized collection of herbarium specimens. The purposes of this herbarium were primarily for teaching and secondarily for scholarly research in economic botany and the ethnobotanical uses of plants. The species in this herbarium are designed to supplement, not duplicate, the extensive floristic collections of the Gray Herbarium and Arnold Arboretum; and with the Economic and Orchid Herbaria, Harvard's herbarium facilities total some 4,500,000 specimens.

The 125th anniversary of the Botanical Museum dates from 1858, when Asa Gray, Professor of Natural History at Harvard, received from Sir William Hooker, Director of the Royal Botanic Gardens at Kew, an acquisition of undetermined size of wood samples, pods, cones, nuts, witches' broom, palm trunks, monkey pots and other vegetable products of economic value for teaching purposes. During the following eighty years, the Botanical Museum grew to become an international centre where plant origins could be studied, drug plants identified and fibres compared. Under the ambitious guidance of Professors

George Goodale and Oakes Ames, the Museum's economic herbarium and products collection grew to nearly 10,000 pressed plants and 7000 vegetal products. Forty-three years ago, a description of the Economic Herbarium was published by Professor Richard Evans Schultes in *Chronica Botanica* v.6 (1940) pt. 4, p .90–91. The Herbarium's growth in scope and size during the ensuing years suggests the advisability of an updated account, and the 125th anniversary of the founding of the Botanical Museum provides an appropriate opportunity for such a review.

With the exception of ornamentals, the Economic Herbarium contains plants which are or have been useful or harmful to man, comprising both cultivated and wild algae, fungi, lichens, pteridophytes and spermatophytes. These general classes of economic plants are included: 1) plants of importance in agriculture (including the principal forage crops), industry and the arts; 2) plants used in primitive societies; 3) plants connected with superstition and religious rites; 4) plants of interest because of former uses or because of association with the old herbals; 5) wild species of significance because of their known or presumed association with the origin of cultivated plants and 6) voucher specimens of phytochemical analyses.

The Economic Herbarium which now numbers 41,000 sheets, has experienced a more than 200% increase in accessions since 1940. Arranged in accordance with the Engler and Prantl system, it comprises material of more than 500 families, 3300 genera and well over 11,000 species and varieties. Included in the Herbarium, as a supplement to the specimens, is a collection of 600 original drawings, watercolors and handcolored prints of economic plants. Another unique aspect of the Herbarium is the inclusion of over 300 photographs of the economically useful species from Harvard's Ware Collection of Glass Models of Plants. This superb public exhibit which is housed in the Botanical Museum and is used extensively for teaching botany by the various botanical institutions of the University, may be viewed as an adjunct herbarium in glass; it provides the scholar with 847 accurate three-dimensional species, including more than 2000 enlarged flower parts and cross sections.

The Herbarium contains material of value to monographers and general taxonomists, including a few types, numerous duplicate types, and drawings of types. There are extensive unique or rare collections which may be of critical or historical importance to students of taxonomy and floristics. *Iter Warburgianum,* the Faurie, the Kunstler, the *Species Blacoanae* and other rare collections are among those of special interest. A complete herbarium of Maiden's *Useful Plants of Australia,* only a few sets of which are known, is preserved in the Economic Herbarium. Ruiz and Pavón's collection of Cinchona barks, a gift from the British Museum (Natural History), and other special generic collections have very significant historical value to students of economic botany.

The Herbarium was initially very rich in Asiatic material. During the past forty years, however, research programs and field work in tropical America have added ample collections from this new world region. The extensive collections of Schultes in Southern Mexico and South America, especially in the Amazon; and the ethnobotanical specimens basic to the studies among the Kamsá and Kofán Indians of South America by Dr. Melvin Bristol and Dr. Homer Pinkley respectively, have enriched the Economic Herbarium. Dr. Tommie Lockwood's collection of Brugmansia primarily from the Andes, and Dr. Timothy Plowman's extensive collections of Erythroxylon and Brunfelsia as well as many other general ethnobotanical species from Colombia and Peru have been added as valuable resource material to the Herbarium. The Theobroma specimens basic to the thesis of Dr. Wertit Soegang are available, and the material on oil palms, especially of the Jessenia-Oenocarpus complex, by Dr. Michael Balick, are included as well. Representative material of Dr. Doel Soejarto's extensive collection of South America Saurauia have been deposited in the Economic Herbarium; and among additional noteworthy collections from other areas are Vestal's ethnobotanical specimens from the Navajo Indians; Schultes' useful plants of the Kiowa of Oklahoma; and Miss Marjorie Whiting's plants of the Kung Bushmen of Botswana, Africa.

Numerous ethnobotanically important plants of the northwest Amazon, especially of the Apocynaceae, collected by Dr. James Zarucchi, have been added to the Economic Herbarium; and an ethnobotanical collection of the useful plants of the Ecuadorian Jivaro Indians made by Mr. Melvin Shemluck, and extensive ethnobotanical plant collections made by Mr. E. Wade Davis in South America, especially in Amazonian Peru and Ecuador, help to enrich the facility. Professor Robert Bye's research on the ethno-ecology of the Tarahumare Indians of Mexico, and Mr. Richard Martin's studies of medicinally promising plants of the Peruvian Amazon, both represent unique additions. More recently, collections of Hevea, Micrandra, and wood samples for anatomical analyses were made by Miss Kristine Forsgard in Brazil along the Amazon inland to the Rio Negro area; and Miss Lynn Bohs' collection of Cyphomandra throughout the Andes, basic to her research in that economic genus of fruits, have also recently been added.

Several specialized collections of voucher herbarium collections have been set up in the Botanical Museum for reference use by scholars—extensive collections devoted to a single genus or species which are or will be valuable to future monographic or analytic studies. Among these are Professor Paul Manglesdorf's extensive maize herbarium, Dr. Walter Hodge's collection of Cinchona, mainly from Peru, and several thousand specimens of Hevea and its relatives made by Professor Schultes in the Amazon Valley. Also available is a Cannabis collection of several hundred specimens from many different areas of North America, Europe and Asia, many collected from the National Institute of Health-sponsored cannabis plantation in Mississippi. The collection is comprised of material introduced and planted from more than 300 localities around the world; their classification basic to a modern interpretation of the genus Cannabis.

There are five other herbaria at Harvard University, and every attempt is made to avoid duplication in the Economic Herbarium of material available in other institutions. The specimens at the Botanical Museum are, however, equally available to both

monographers and specialists; and efforts are currently being made to send out material for annotation, citation in publications, and to fill in gaps in our representation of economic plants of the world. We believe that this specialized herbarium is and will remain basic to contemporary growth and interest in the teaching of and interest in economic botany.

The Economic Herbarium is catalogued under the Dalla Torre and Harms' genus number. It is closely integrated with an extensive collection of economic and ethnobotanical plant parts, including seeds, fruits, flowers, roots, woods, barks, oils, resins, rubbers and other vegetal products. This teaching collection of useful plant products numbers well over 14,000 entries and has had a 100% increase in accessions since 1940. Likewise available is a collection of 4000 habit photographs of economic plants, 300 related charts and graphics and a clipping file assembled over the past fifty years. All of these facilities are reinforced for teaching and research by the topically indexed interdisciplinary Economic Library of Oakes Ames with well over 35,000 titles.

A recent addition from the New York Botanical Garden is the collection of economic plants of Dr. Henry Rusby, dating from the early 1900's. Representing only a portion of Rusby's collected material, the 4000 specimens, stored in antique apothecary jars, is a unique part of a massive accumulation of medicinal and general economic flora from Arizona, New Mexico, Colombia, Brazil and the Lower Orinoco area. A preliminary examination of this outstanding collection by Miss Susan Rossi has already produced a long-lost type specimen of *Erythroxylon truxillense* and promises to yield other critical specimens.

The Curator of the Economic Herbarium from 1954 to the present is Professor Schultes. Since 1976, Mr. Scott Wilder has acted as Assistant to the Curator and Manager of Economic Botany Collections. He has revitalized the Museum's botanical holdings, has organized a separate and more effective collection of herbarium specimens for laboratory use in teaching, and rehabilitated exhibits in the Nash Lecture Hall where economic botany courses are taught. Graduate students, as part of their

training within the department, have undertaken to assist the Curator and Mr. Wilder in day-to-day management of the Herbarium.

The value of the Economic Herbarium of Oakes Ames and the teaching collection of Useful Plant Products lies in their importance as tools of instruction and research in ethnobotany and economic botany as well as being a repository for voucher specimens of chemical analyses of plants by schools of pharmacy and chemistry and pharmaceutical establishments. The Botanical Museum has provided 125 years of accessibility to students of botanical science, and the Museum's specialized collections offer a facility for research which might be difficult or impossible to satisfy in the larger and more generalized herbaria dedicated to a study of the floras of the world.

Scott E. Wilder
Curatorial Assistant

THE WARE COLLECTION OF BLASCHKA GLASS MODELS OF PLANTS

Millions of persons who have visited the Boston area remember Harvard University as the home of the "Glass Flowers." Exhibited on the third floor of the Botanical Museum are 18 glass models of orchids which are now almost 100 years old. They arrived from Germany in April of 1887 as part of the initial shipment of glass models of plants created in the studio of Leopold and, later his son, Rudolph Blaschka in the small town of Hosterwitz-bei-Dresden, the first of 850 models produced by these artists between 1886 and 1936 and sent to Harvard in 23 shipments.

The first few shipments of models numbered in the twenties because of part-time production. Later, when the Blaschkas worked on plant models full time, 50 to 60 were sent at one time. After Leopold's death in 1895, Rudolph working alone sent fewer models in each shipment, usually in the twenties and none in some years due to World War I and other interruptions.

In the early 1880's, Professor George Lincoln Goodale, the first director of the Botanical Museum, was in the process of planning the Museum's exhibits. In addition to being very instrumental in raising funds for the construction of the building, he was preoccupied with plans for equipping the building for research and instruction. In order to provide materials for botanical instruction, he explored several possibilities. At that time, plant reproductions were being made from wax and paper maché, neither of which were really satisfactory for his purposes. He had in mind plant reproductions which would be on a par with the three dimensional specimens of animals he had seen in Harvard's Museum of Comparative Zoology where there were exhibited a number of life-like glass models from the Blaschka studio. Impressed with their fidelity to the living forms and believing that they might also make plants, he visited them in Germany. Cordially received, he stated the purpose of his visit. Leopold was reluctant to take on the project. Some years earlier he had made a few plant models, but in view of difficulties in receiving proper payment for them, he was resuming work on animals. Furthermore, the marine invertebrate models that he and his son were producing for many museums were providing them with a satisfactory income.

Professor Goodale must have been persuasive, because at that first meeting he did get Leopold to agree to create a few models to be sent to Cambridge. Reaching New York, they were badly damaged in customs. Notwithstanding this misfortune, the broken models were forwarded to Cambridge, where they were shown to a group of friends of the Museum. It was evident, even in their damaged state, that they were of very high quality. Two of the Museum friends present at this showing were sufficiently impressed to authorize Professor Goodale, on their behalf, to engage the artists to produce more glass models of plants. The Blaschkas agreed on a half-time basis, while continuing to produce models of marine invertebrates for other museums. They worked in this manner from 1887 until 1890, when they decided to work with plants or invertebrates but not with both. On April 16th, 1890, the die was cast in favor of plant models when they signed a ten year contract to make plant models exclusively for Harvard University.

The models were to be sent in two shipments each year. The contract stipulated that the payment for the models, 8,800 marks per year, would be payable in half-yearly installments, 4,400 marks on January first and 4,400 marks on July first. It was also agreed that all expenses of freight from the place of manufacture to Cambridge, of insurance and of consular certificates would be defrayed. On the 10th of the following month, May 1890, the two friends of the Museum who had agreed to finance the project—Mrs. Elizabeth Ware and her daughter, Miss Mary Lee Ware of Boston—presented the collection to the President and Fellows of Harvard College as a memorial to the late Dr. Charles Eliot Ware of the class of 1834. It was gratefully accepted and became a distinctive part of the Botanical Museum collections.

In the early stages of the assembly of this collection in Cambridge, it was shown to the public at various times. Later, when the collection assumed its final form and was exhibited in display cases made for the purpose, it became and still is very popular with the public. From 80,000 to more than 100,000 visitors view the models every year. Visitors from every state in the union and over fifty countries have signed our visitors' register. No record has been kept of the number of students who have visited the collection for study, but the number must be in the thousands.

When the production of the collection was started, judicious choices had be made concerning species to be represented, inasmuch as the duration of the project was then expected to extend over a relatively short time span. As it turned out, the original ten-year contract was renewed a number of times, so that eventually the collection included a good representation of the Plant Kingdom, from the simplest forms to the most complex and it is now arranged in accord with the Engler-Gilg phylogenetic system of classification.

The Blaschkas worked from material grown in their own garden from seeds and cuttings sent from this country and other sources. Some plants unsuited to growing outdoors in their area were made available to them from the greenhouses at the castle in nearby Pillnitz. In 1892, they needed certain plants not locally available, so Rudolph came to the United States and to the

Caribbean. He made drawings, color notes, and preserved some specimens to be taken back to the studio in Germany for use in preparing models. While he was in the United States on a similar mission in 1895, his father died, and he returned to his home immediately, never to return to Cambridge. Following his father's death, Rudolph continued making the plant models but in reduced numbers each year.

The question as to how the models were made by the Blaschkas and the existence or non-existence of "secrets" connected with their manufacture has been rather controversial. It can be said that, for all intents and purposes, there were no "secrets." Their methods for working with glass were known to other glass-workers at the time. No doubt certain techniques were handed down to them in the family which had for generations worked with glass. Furthermore, they had themselves probably developed approaches to their work that may have been unique. The singularity of their work was due to the combination of their various talents. They were both well grounded in the natural sciences. This familiarity was founded, not only on formal instruction in the classroom, but to a great extent on observation and study of the flora and fauna of their surroundings. Coupled with this was their possession of a highly developed artistic sense.

As to the actual creation of the models, we know that the heated glass was manipulated and shaped in various ways through the use of simple implements: pincers, tweezers and other small tools of their own devising. The various parts of a model were assembled with the use of the blow-flame and, in some cases, various parts, such as long slender stems, were strengthened by the inclusion of wire. Occasionally, some of the parts were formed of colored glass in which case the part was considered finished. In other instances, when the parts were formed of clear glass, they were assembled, and the surface was coated with a material incorporating mineral pigments. This technique was used for many of the plant models as well as for all of the invertebrates.

Preliminary analysis of the material that they used indicates that it was either a gum or glue or a combination of both.

Unfortunately, this material responds to variations in humidity. When the humidity falls, the material contracts and pulls away from the glass. For a number of years, the variation in humidity has caused the contraction and expansion of this material on some of the models to such an extent that it has separated completely from the glass, a condition readily visible in many plant cross-sections. A constant temperature and humidity system has been installed to reduce this damage to a minimum. By stabilizing the collection, it will prevent further depreciation.

There is another aspect of the creation of these models which should be mentioned. In the late 1890's, as Rudolph continued modelling plants, he became dissatisfied with the quality of the glass available to him, and he decided to make his own glass. Consequently, he had several glass furnaces installed in his studio and proceeded to produce glass himself from the raw materials. He further proceeded to work toward another objective: to improve on one of the techniques involved in his work. As mentioned above, many of the plant and all of the invertebrate models were made of clear glass and colored by applying a mineral material with glue and/or gum. This surface material could be scratched off and was susceptible to changes in humidity. It was Rudolph's intention to make the models in such a way as to eliminate these shortcomings. He prepared the parts of a plant of clear glass; instead of applying the glue-gum-pigment mixture, he added powdered glass of the desired color to the surface and re-heated the parts in the flame, thus fusing the clear and the powdered glass. It was a somewhat chancy procedure, inasmuch as the second heating of the part sometimes caused the glass to fracture. When successful, this process assured a more durable model. Rudolph was successful in this endeavor to a certain extent but we cannot say how many of the models were completed in this manner. We do know that some of the cross-sections were definitely made in this way, for it can be visually determined. Other models, however, may have been made in this way, but it cannot be detected merely by visual examination. After the application of powdered glass and fusion, the piece so treated appeared glassy; to overcome this deficiency, he coated the surface with a material to eliminate the glassy shine.

This information is available from a letter written by Miss Ware to Prof. Oakes Ames, the second director of the Botanical Museum. After having spent a day watching Rudolph at work, she wrote: "There is additional labor which I did not see. Annealing leaves the glass glittering and shining, and that appearance he destroys by the application of a certain varnish; and he applies this to the flowers also after stamens and pistils are set." There may well be any number of models made using this newer method, but to determine this would require very close examination. Based on the information now available, there is no record concerning the number of models that were produced in this way. The one exception mentioned earlier concerns the model of the Maple with the autumn coloring. We have letters about that model written by Rudolph in which he relates difficulties encountered to produce a glass of the proper red for the leaves: he wrote that the model had been fashioned almost completely in the new manner, except that the veins on the backs of the leaves had to be, as he put it, "helped with cold painting"—a reference to the application of the glue-gum-pigment material.

We hope that in the future it will be possible to analyze this material. If that were done, it would be possible to duplicate the surface material and thus restore areas of some of the models where the material has been completely detached and thus improve the appearance of these models.

Some models show more damage than the lifting or separation of the coating material from the glass surface. Almost without exception it is the leaf structure which has been damaged beyond repair. In these cases, the leaves are almost completely fragmented. It has been suggested that this destruction might be due to three factors: one is the strength of the coating material when it contracts; another is the thinness of the underlying glass; and the third is possibly the age of the glass. The only remedy would be complete replacement of the damaged part. Since glass workers able to do this very difficult work are probably unavailable, the only possibility would be to make a plastic replica of the missing part. This solution is completely feasible. Preliminary investigations along this line are now being undertaken.

The plastic replica could be put in place, and a label explaining the substitution could accompany the model.

Recently, possibilities have been explored to find a way in which the models might be cleaned, but to date no really satisfactory method has been found. The collection at present is housed in very well made horizontal and vertical exhibit cases, some of which date back to the 1890's. Although of high quality, they are aging. Many of them are still sound, but in some cases, the joints have dried out and have loosened. During the past ten years, a few have had to be repaired. Most of these repairs concern loose legs on the horizontal cases, discovered in moving the cases to install the recently completed air conditioning system.

The collection is adequately lighted, but it does have a few drawbacks. The light from the overhead fluorescent fixtures is reflected from the glass in the horizontal cases; the reflection interferes to a certain extent with viewing the models. Furthermore, the overhead lights cause shadows on parts of the models in the vertical cases. When installed, this lighting was probably the most satisfactory type available. If the entire collection were to be housed in vertical cases equipped with interior lighting, these drawbacks could be eliminated; then, all the models on exhibit could be seen by viewers at close range, an advantage not now possible for the models in the horizontal cases.

It has also been suggested that the collection could be "thinned out" somewhat and still maintain the phylogenetic continuity so useful for teaching purposes. With fewer models on exhibit, all in vertical cases, floor space would be gained to accommodate the increasing numbers of visitors. At present, the aisle space between cases is adequate when only a few people are present, but when groups of fifty or more are circulating in the aisles, the space is quite cramped.

Some years ago an attempt was made to raise funds to solve some of these problems, but it was only partially successful. A sufficient amount was raised to provide for installation of the constant temperature and humidity control system mentioned above. That environmental improvement was considered to be

the most important need of the collection. Perhaps in the future, means will be found to solve the remaining problems so that this unique "marvel of science in art and marvel of art in science" may be in good condition a century from now.

William A. Davis
Keeper of Scientific Exhibits

THE PRINTING SHOP

The first equipment—the embryonic printing shop—consisted of a small foot-powered, 7 x 10 job press, and a few cases of type acquired between 1912 and 1914 for Mr. Louis C. Bierweiler, former curator of exhibits, to print labels for the Glass Flower display. Proliferation of his duties, however, made it impossible for him to continue to operate the printing press, and in November 1930, Mr. Howard J. Allgaier, freshly out of high school, assumed this reponsibility.

At that time, Professor Oakes Ames, Director of the Botanical Museum, an enthusiast for fine printing, decided to establish a real printing press operation as an eventual outlet for publishing the results of scientific research done by the members of the Museum. He often said: "A botanist's research should be a jewel worthy of a proper setting". To do that, in 1932, he acquired another foot-powered, 10 x 15 Golding job press. It was on June 7, 1932, that the Museum's own journal—the BOTANICAL MUSEUM LEAFLETS—now in its 29th volume, was initiated. This endeavor was highly successful and has materially contributed to the Museum's rapid rise to one of the most respected botanical institutions.

The following year, in 1933, Professor Ames, who at that time was also Supervisor of the Arnold Arboretum, used the new press to publish the Arnold Arboretum's BULLETIN OF POPULAR INFORMATION This publication contained half-tone pictures, the printing of which a "job press" was completely unsuitable. Yet, the problems were successfully overcome. The quality of print-

ing at the Museum soon attracted the attention of various Harvard institutions: the Museum of Comparative Zoology, Department of Biology and the Medical School on a regular basis, while others used the facility occasionally.

The press was so successful that Professor Ames decided to try to print a full size book. In July 1936, the first, all hand-set, volume of 234 pages in Scotch Roman type, printed two pages at a time, was completed, and Ames, Hubbard and Schweinfuth, THE GENUS EPIDENDRUM was published. It should be mentioned that only 16 pages were set and printed at a time, then the type distributed so that another 16 pages could be set. The quality of this hand-set book on fine paper caused admiration in botanical circles which in turn gave the impetus for continuing the printing of books on an intermittent basis.

Realizing that a "job press" was not the right equipment to print the kind of books that he wanted to produce in the future, Professor Ames, in October 1937, purchased a 12 x 18 Chandler and Price power-press equipped with an automatic feeding system. This excellent press, although now outdated, is still in use 45 years later.

The printing of the second book Ames, ECONOMIC ANNUALS AND HUMAN CULTURE, 160 pages, 7½ x 12 inches, was completed in December 1939. From that time on, the press had very little time to rest. During 1939, Vestal and Schultes, THE ECONOMIC BOTANY OF THE KIOWA INDIANS, 110 pages, was also printed. In 1940, Taylor, PLANTS USED AS CURATIVES BY CERTAIN SOUTHEASTERN TRIBES; in 1941, Schultes, A CONTRIBUTION TO OUR KNOWLEDGE OF RIVEA CORYMBOSA, 45 pages; in 1947, Ames, DRAWINGS OF FLORIDA ORCHIDS, 190 pages, 63 plates, and in 1948, Ames, ORCHIDS IN RETROSPECT, 172, pages were all published.

During the intervening time, between 1941 and 1970, the press also printed JOHNSONIA, the occasional journal of the Mollusk Department of the Museum of Comparative Zoology, and for the same department, from 1945 onward, the OCCASIONAL PAPERS ON MOLLUSKS were produced.

In June 1976, after 46½ years of service to the botanical world in general and to the Harvard community in particular, Howard

Allgaier retired from full time service. Yet, on a part time basis, he continues to serve the needs of various Harvard institutions which desire the fine quality of workmanship that only hand-set printing can give.

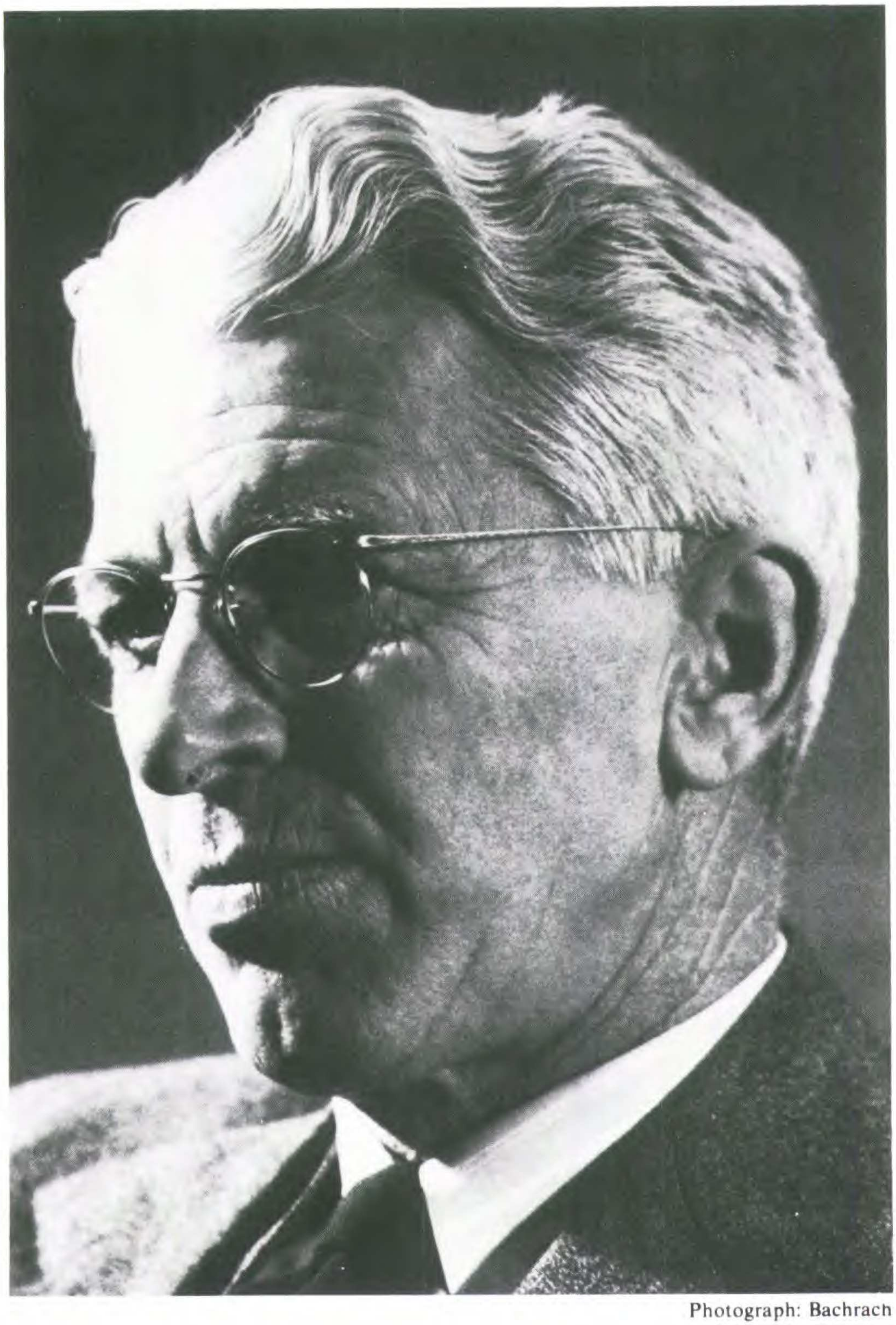
Howard J. Allgaier
Printer to the Museum

PLATE 1

Photograph: E. Molitsky

Professor Richard Evans Schultes

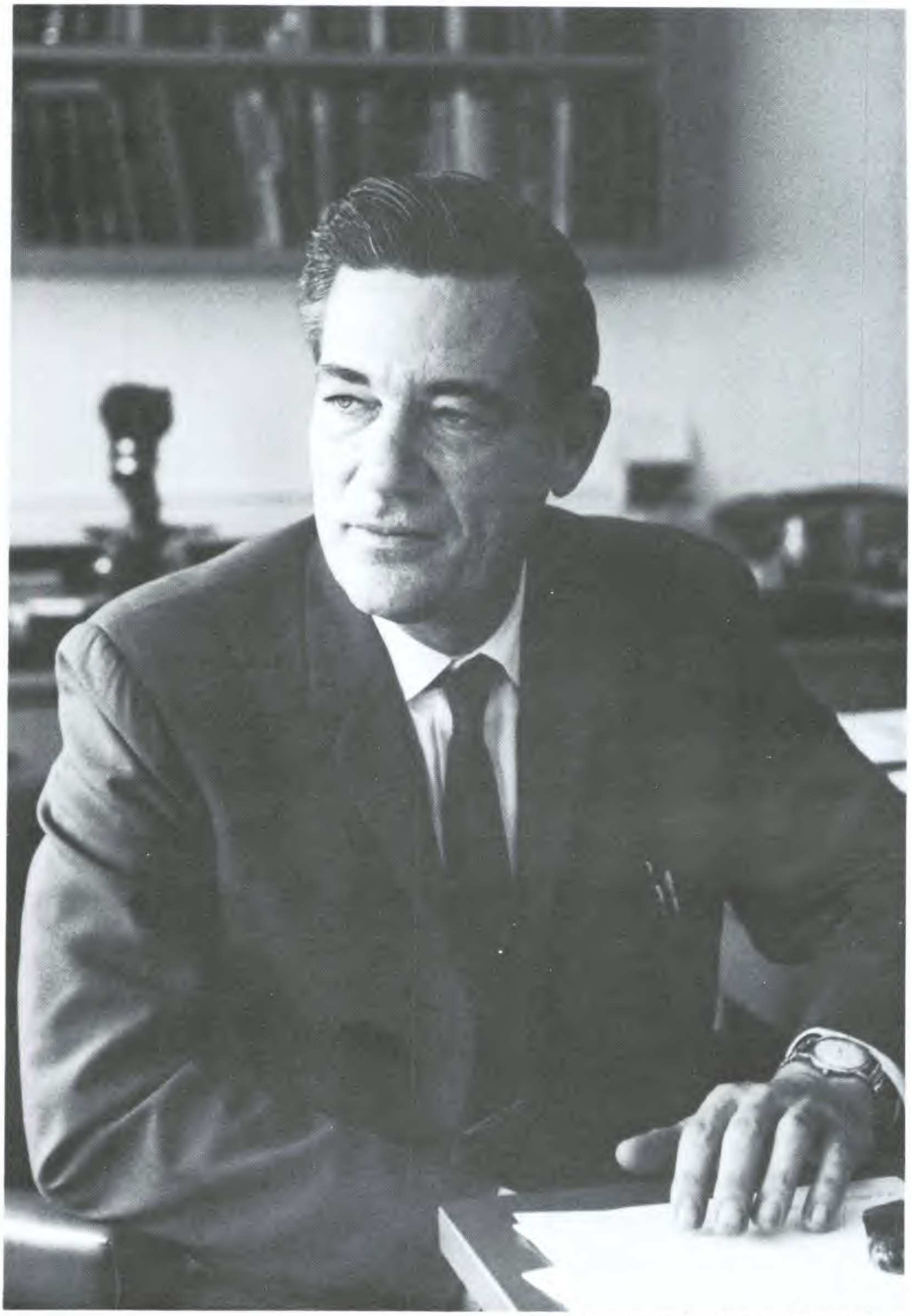
PLATE 2



Photograph: Bachrach

Professor Paul C. Mangelsdorf

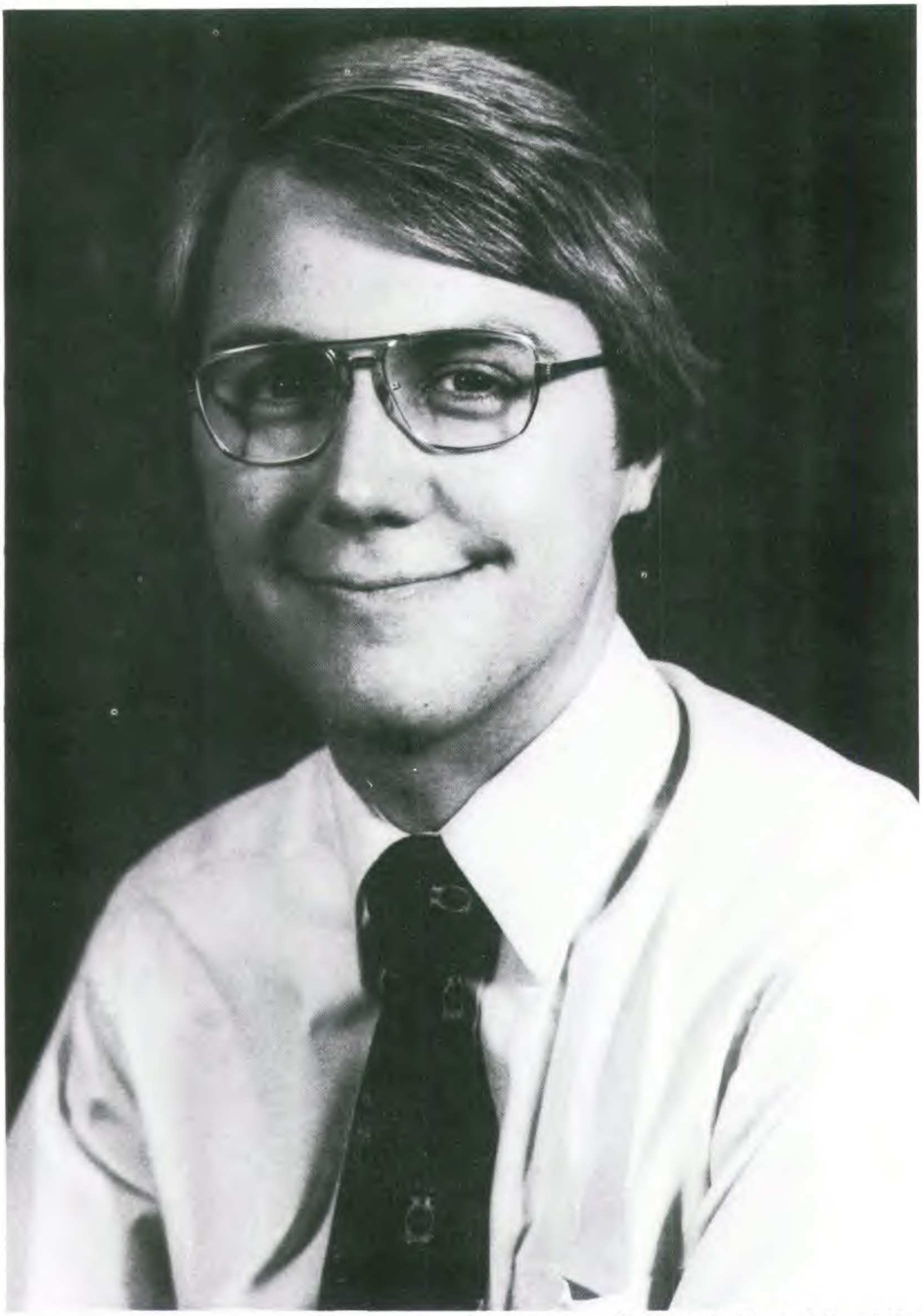
PLATE 3



Photograph: Harvard News Office

Professor Elso S. Barghoorn

PLATE 4



Photograph: Harvard New Office

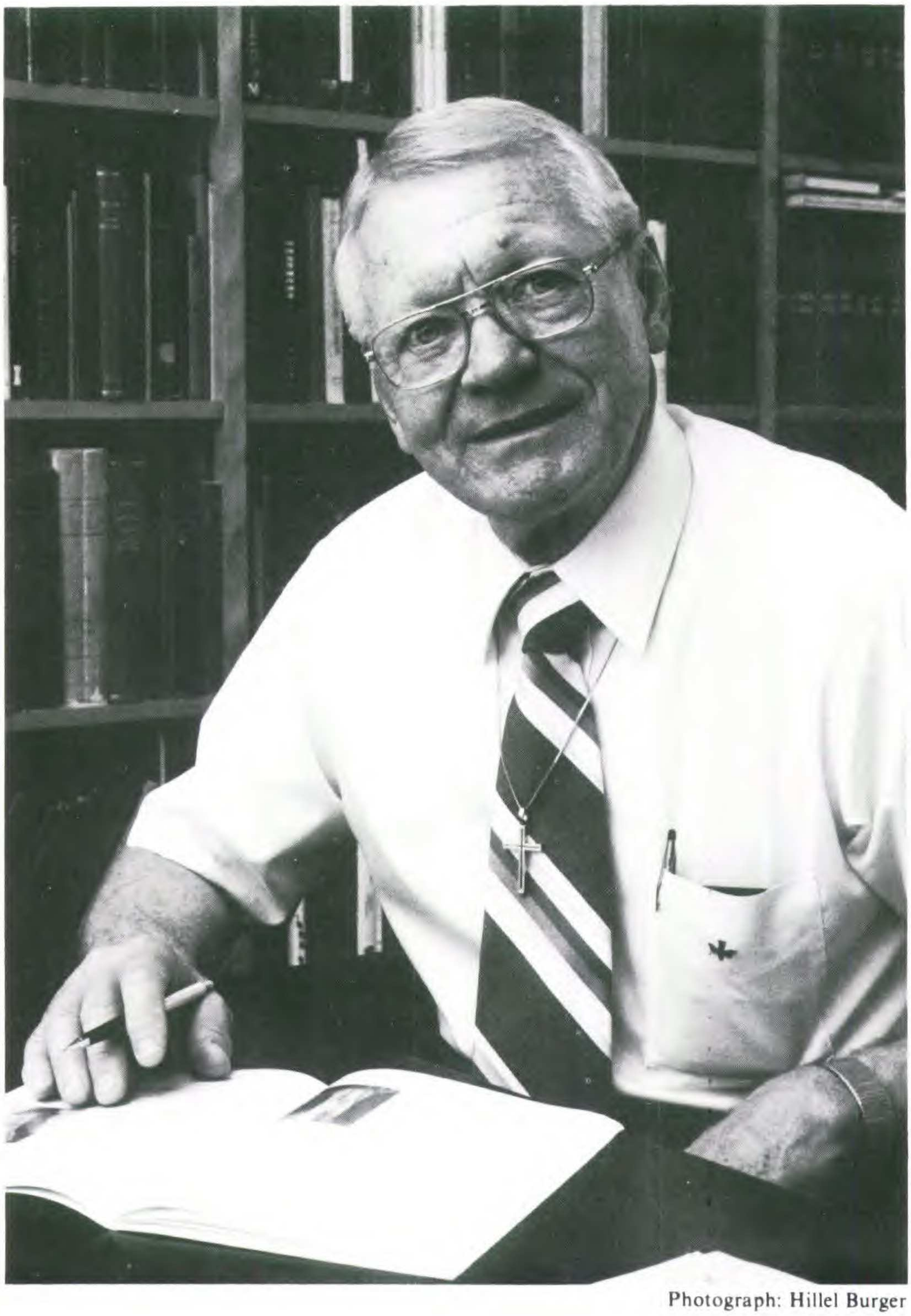
Professor Andrew H. Knoll

PLATE 5

Photograph: Hillel Burger

Professor Herman R. Sweet

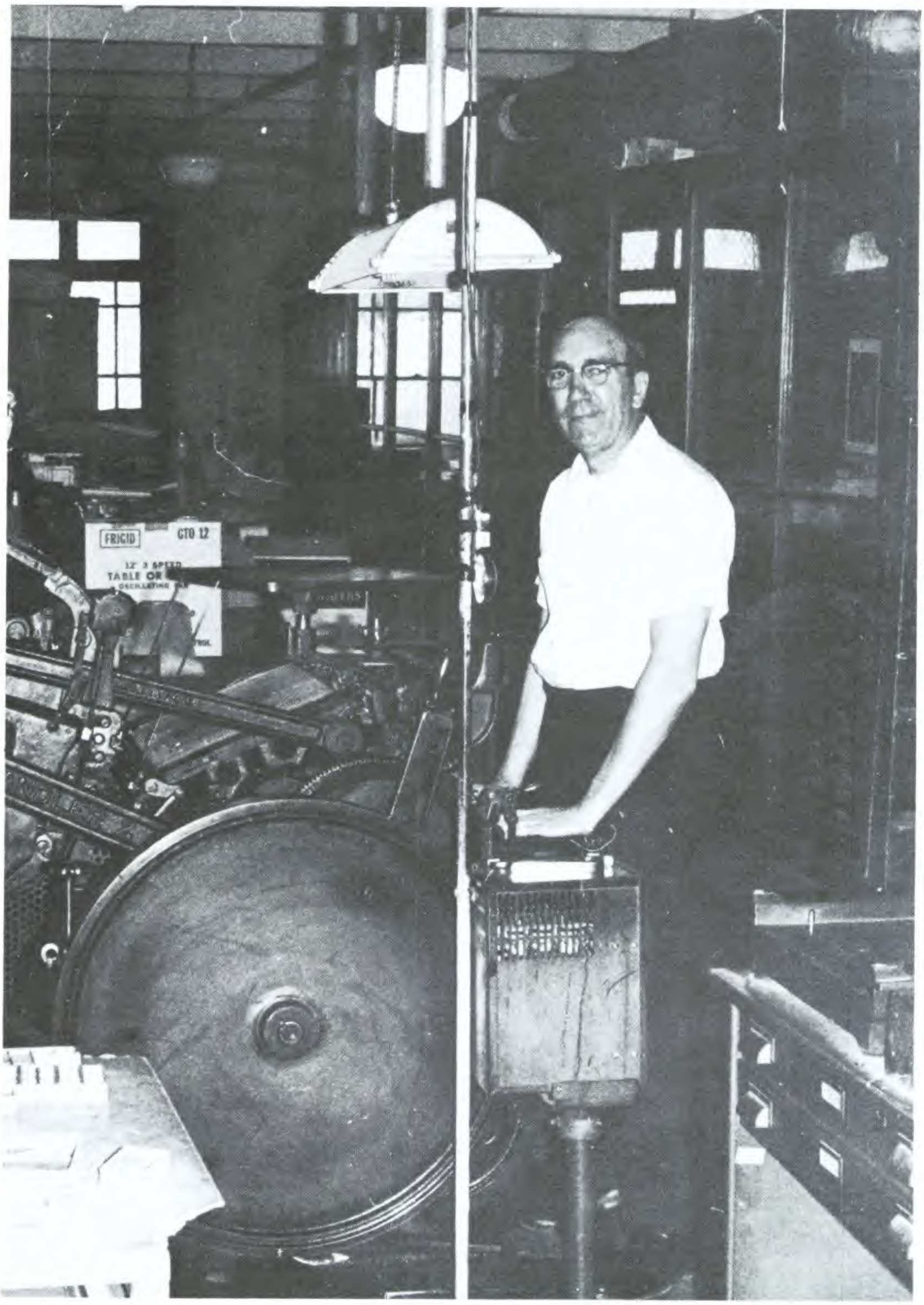
PLATE 6



Photograph: Hillel Burger

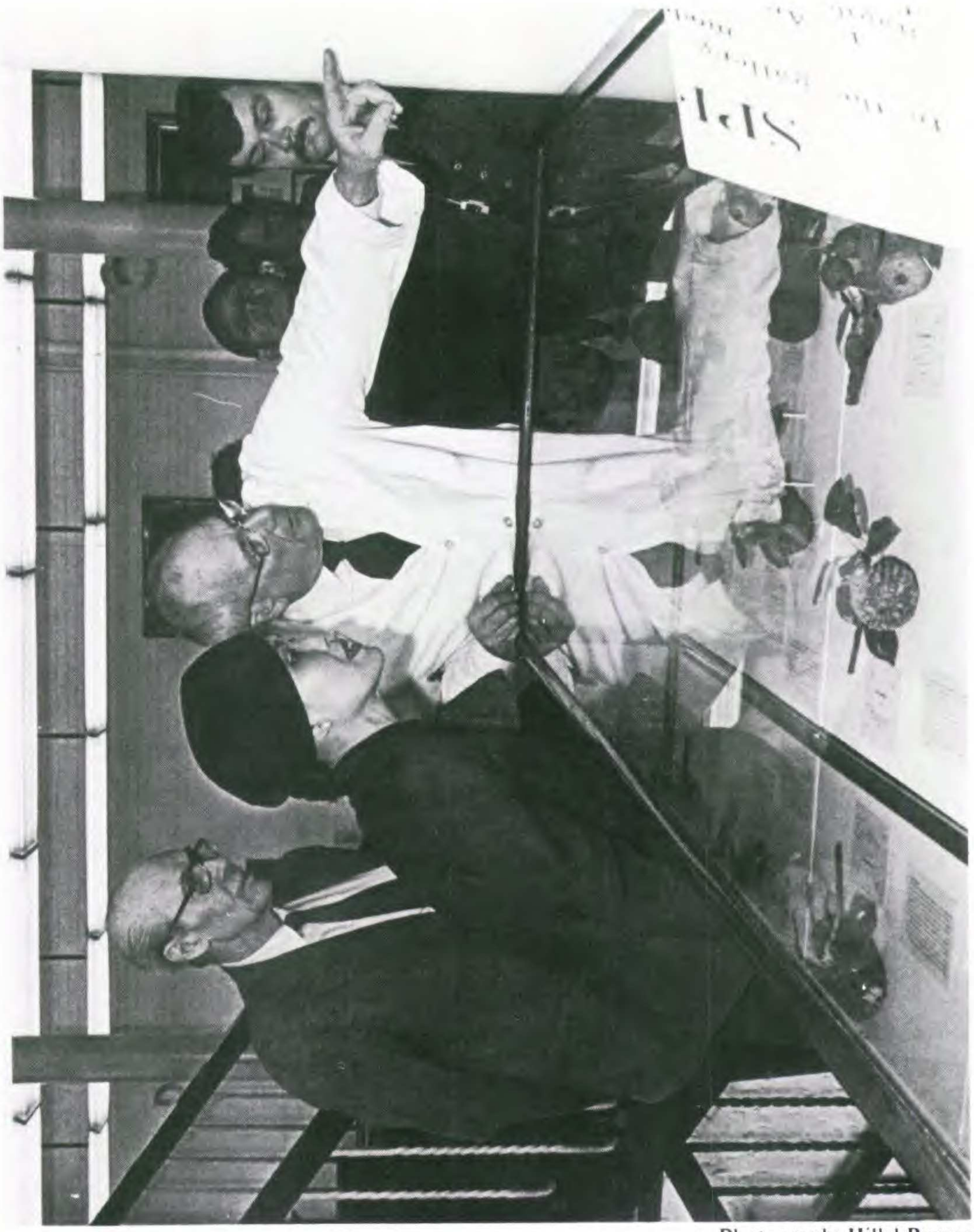
Dr. Leslie A. Garay

PLATE 7



Mr. Howard Allgaier
in the printing shop of the Botanical Museum.

PLATE 8



Photograph: Hillel Burger

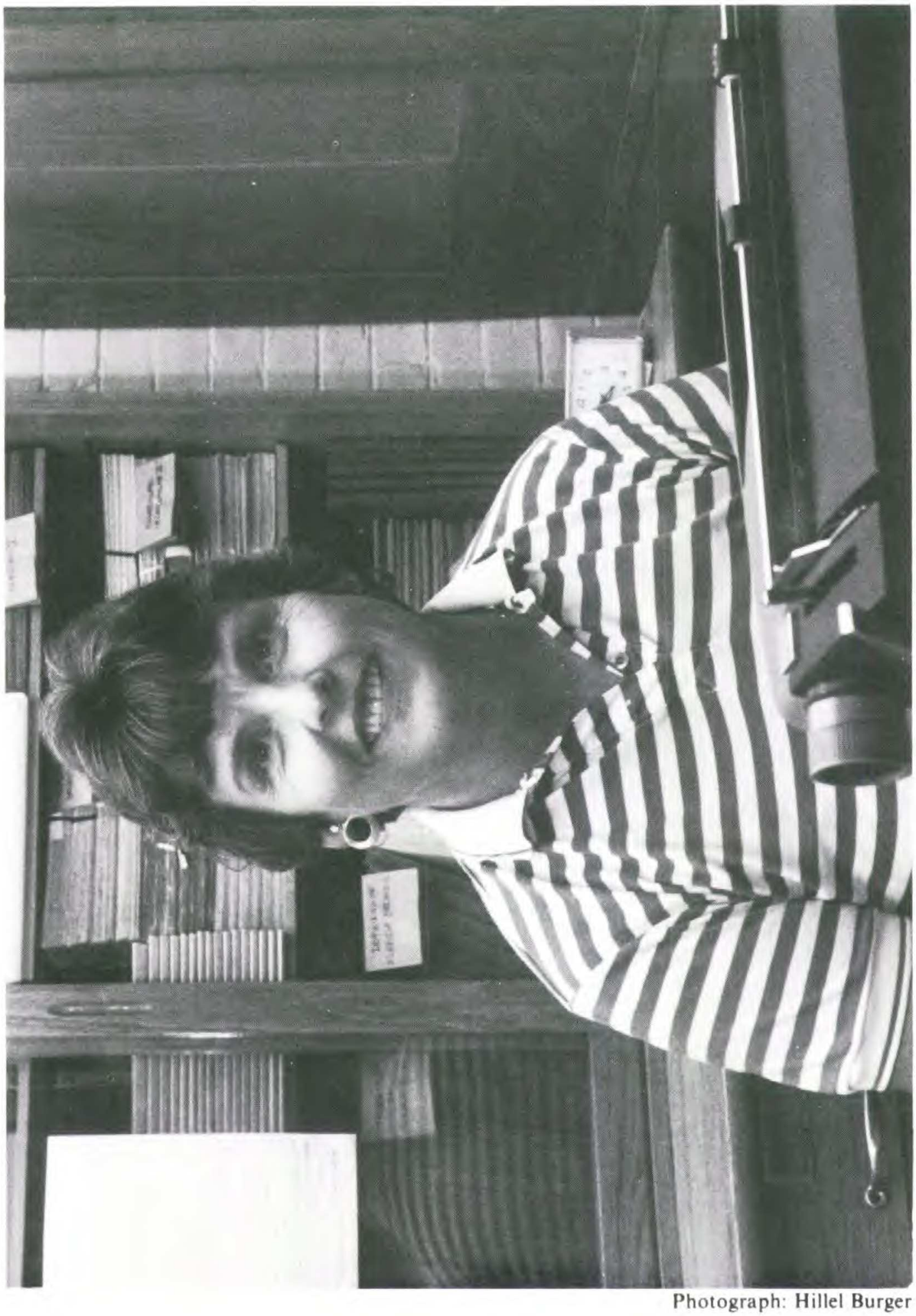
Mr. William A. Davis and Professor Richard Evans Schultes
explaining the Ware Collection of Glass Models of Plants
to Her Royal Highness, Queen Sirikit of Thailand, during
her recent visit to the exhibit.

PLATE 9

Photograph: Hillel Burger

Mrs. Mary R. Gaudet

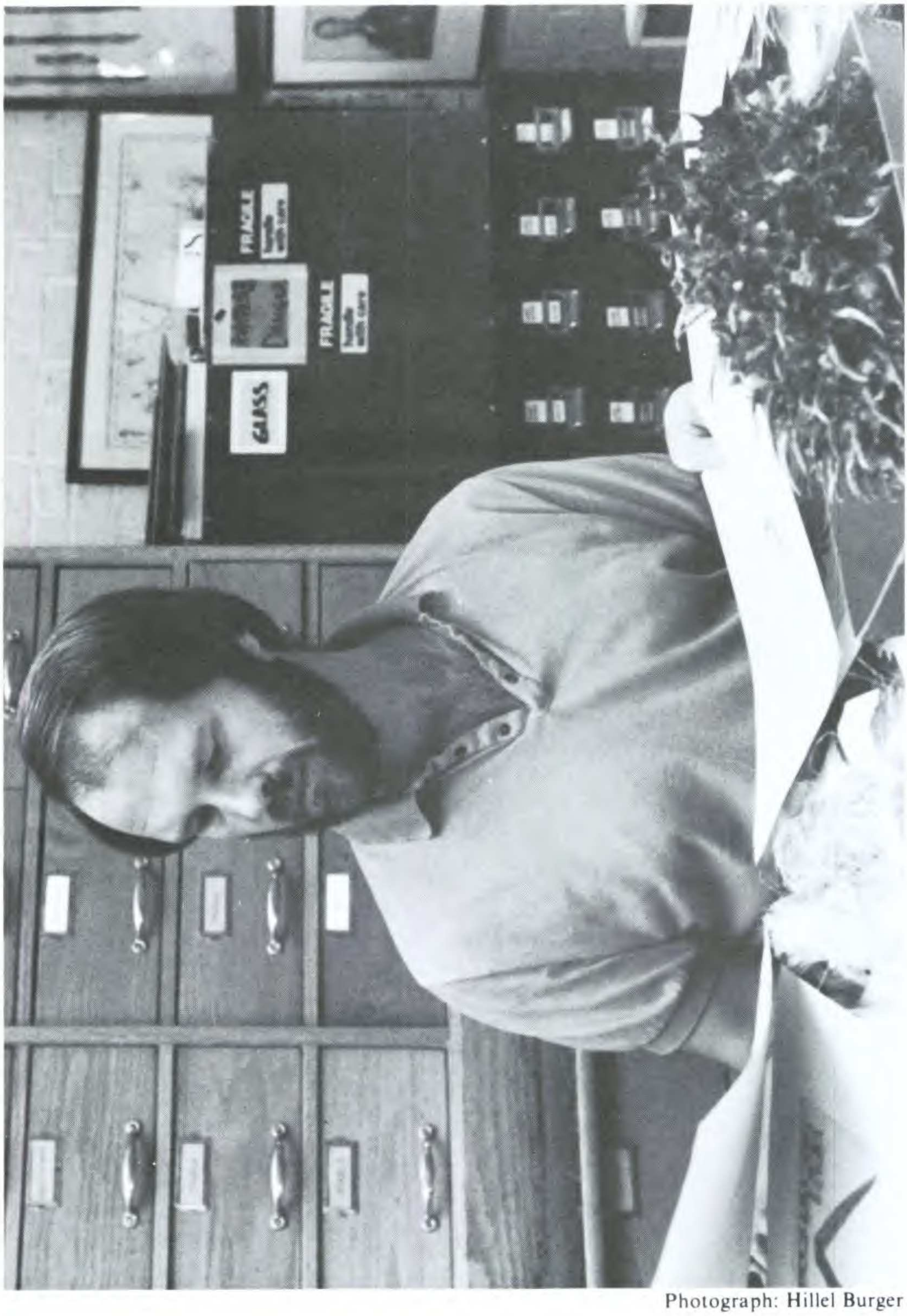
PLATE 10



Photograph: Hillel Burger

Mrs. M. Katheryn Harrow

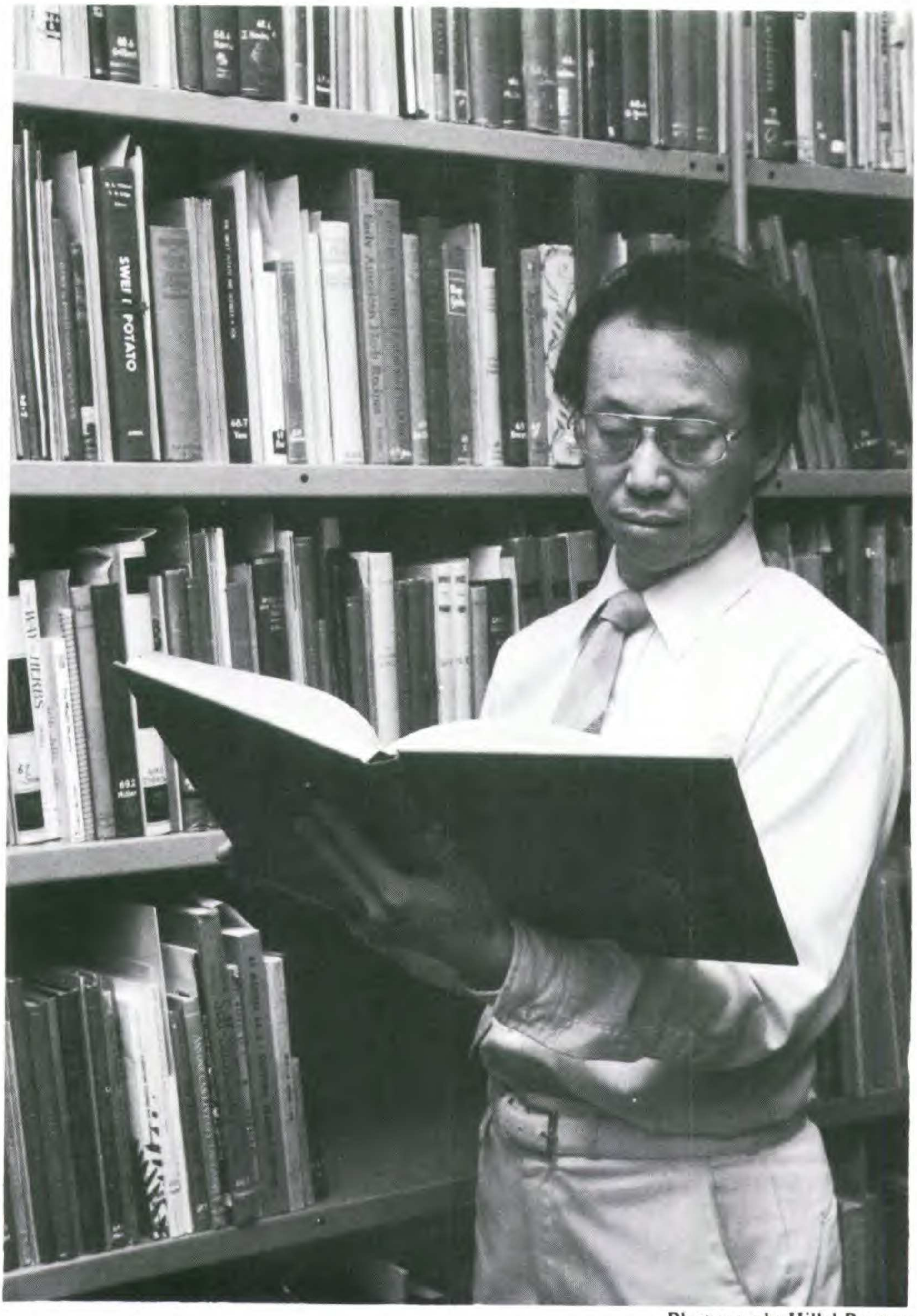
PLATE 11



Photograph: Hillel Burger

Mr. Scott E. Wilder

PLATE 12



Photograph: Hillel Burger

Mr. Wesley Y. Y. Wong